सत्यमेव जयते

THE

# INDIAN ASTRONOMICAL EPHEMERIS

FOR THE YEAR

2021

POSITIONAL ASTRONOMY CENTRE
INDIA METEOROLOGICAL DEPARTMENT
MINISTRY OF EARTH SCIENCES

THE

# INDIAN

# ASTRONOMICAL EPHEMERIS

FOR THE YEAR

2021

**POSITIONAL ASTRONOMY CENTRE**

**INDIA METEOROLOGICAL DEPARTMENT**

*Issued under the authority of*

**THE DIRECTOR GENERAL OF METEOROLOGY, NEW DELHI**
**INDIA METEOROLOGICAL DEPARTMENT**
**MINISTRY OF EARTH SCIENCES**
**GOVERNMENT OF INDIA**

*Office of preparation*

**POSITIONAL ASTRONOMY CENTRE**
**INDIA METEOROLOGICAL DEPARTMENT**
**SALT LAKE, KOLKATA - 700 091**

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# PREFACE

The Indian Astronomical Ephemeris is published annually by the India Meteorological Department (IMD) for providing data to astronomers. The speciality of this publication is that it contains calendric information which caters to the requirement of the country's panchang makers and other users. Thus, it has great civil and cultural significance. This has been mandate given to the Positional Astronomy Centre at Kolkata by the Govt. of India.

The calculations of the Indian Calendar portion, such as tithi, nakshatra, etc. are given in Indian Standard Time (IST) and covers an extended period upto 21st March, 2022 which is the end of the year 1943 Saka Era of the Indian National Calendar. A separate note has also been given to explain the terminology and the basis of different calculations relating to the Indian Calendar.

The epoch of the standard reference system in this publication is J 2000.0 and the argument of the ephemerides is Terrestrial Time (TT). Resolutions of the Indian Astronomical Union (IAU) recommending the changes from time to time including a list of new IAU constants are given in Part VI – Indian Calendar and Explanation.

Our sincere thanks are due to the Nautical Almanac Office, United States Naval Observatory and Her Majesty's Nautical Almanac office, U.K.

The work of preparation and publication of the Indian Astronomical Ephemeris for 2021 has been done under the supervision of Shri S. Sen, Head, Positional Astronomy Centre, India Meteorological Department, Kolkata.

Dr. M. Mohapatra
Director General of Meteorology

Mausam Bhawan
New Delhi – 110 003
30th Sept. 2020 A.D.
(Asvina 8, 1942 Saka Era)

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# CONTENTS

# PART - I

## TIME, SUN, MOON, PLANETS

Julian date for Standard epoch

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1900 January 0, $12^h$ U.T. | | | | = | JD | 241 | 5020.0 |
| B | 1950.0 | = | 1950 Jan. 0.923 | = | JD | 243 | 3282.423 |
| B | 2021.0 | = | 2021 Jan. 0.120 | = | JD | 245 | 9214.620 |
| J | 2021.5 | = | 2021 July 2.375 | = | JD | 245 | 9397.875 |
| J | 2000.0 | = | 2000 Jan. 1.5 | = | JD | 245 | 1545.0 |

Tabulations of Julian date against calendar date for 2021 are given on pages 4 to12 and for other years are given at Table IX of Part-V on page 355.

The fraction of the year from 2021.5 is tabulated with the Besselian day numbers on pages 244-251.

---

The lengths of the principal years and mean months at 2021.0 as derived from the Sun's mean motion and mean Orbital elements respectively are:

Length of the year (ephemeris days ) :

| | d | | d | h | m | s |
|---|---|---|---|---|---|---|
| Tropical (equinox to equinox ) | 365.242190 | = | 365 | 05 | 48 | 45.2 |
| Sidereal (fixed star to fixed star) | 365.256363 | = | 365 | 06 | 09 | 09.8 |
| Anomalistic (perigee to perigee) | 365. 259635 | = | 365 | 06 | 13 | 52.5 |
| Eclipse (node to node) | 346. 620074 | = | 346 | 14 | 52 | 54.4 |

Length of the Month (ephemeris days)

| | d | | d | h | m | s |
|---|---|---|---|---|---|---|
| Synodic (new moon to new moon) | 29.5305888 | = | 29 | 12 | 44 | 02.9 |
| Tropical (equinox to equinox) | 27.3215822 | = | 27 | 07 | 43 | 04.7 |
| Sidereal (fixed star to fixed star) | 27.3216615 | = | 27 | 07 | 43 | 11.6 |
| Anomalistic (perigee to perigee) | 27.5545501 | = | 27 | 13 | 18 | 33.1 |
| Nodical (node to node) | 27.2122207 | = | 27 | 05 | 05 | 35.9 |

| | | h | m | s |
|---|---|---|---|---|
| Length of the day: | Mean Sidereal | 23 | 56 | 04.09053 of mean Solar time. |
| | Mean Solar | 24 | 03 | 56.55537 of mean Sidereal time. |

# CHRONOLOGICAL TABLE

## CHRONOLOGICAL CYCLES

| | | | |
|---|---|---|---|
| Golden Number or Lunar Cycle | VIII | Solar Cycle | 14 |
| Epact | 16 | Roman Indiction | 14 |
| Dominical Letter | C | | |

## CHRONOLOGICAL ERAS

The year 1943 of the Saka Era (Indian National Calendar) begins on March 22, 2021.
The year 1943 of the Saka Era or Saka Shalivahana (Lunisolar, Traditional Calendar) begins on April 13, 2021.
The year 1943 of the Saka Era (Solar, Traditional Calendar) begins on April 14, 2021.
The year 5122 of the Kali Era begins on April 14, 2021.
The year 2078 of the Vikram Samvat begins on April 13, 2021 (Chaitradi) and November 05, 2021 (Kartikadi) according to different systems of reckoning.
The year 1428 of the Bengali San begins on April 15, 2021.
The year 1197 of the Kollam Era begins on August 17, 2021.
Jovian year (Barhaspatya Varsa or 60-year cycle of Jupiter) 49 Raksasa begins on May 28, 2018 (North Indian Usage), and 35 Plava April 13, 2021 (Lunar Chaitradi) or April 14, 2021 (Solar) (South Indian Usage).
Vedanga Jyotisa year 2- Parivatsara of the 5-year cycle (389 th cycle of Paitamaha Siddhanta) begins on February 12, 2021.
The year 2565 of the Buddha Nirvana Era begins on May 26, 2021.
The year 2548 of the Mahavira Nirvana Era begins on November 04, 2021.
The year 1443 of the Mohammedan Era begins on August 10, 2021.
The year 1391 of the Yazdejardi Era begins on August 16, 2021 according to the Parsi (Shahenshahi) Calendar.
The year 6734 of the Julian period begins on January 14, 2021.
The year 5782 of the Jewish Era (A.M. ) begins on September 07, 2021.
The year 2797 of the Greek Olympiad, being the 1st year of the 4-Year cycle ( 700 th Olympiad ) begins on July, 2021.
The year 2774 of the Foundation of Rome ( A.U.C. ) begins on January 14, 2021.
The year 2770 of the Nabonassar begins on April 18, 2021.
The year 2333 of the Seleucidean Era begins in the present-day usage of the Syrians on September 14 or October 14, 2021 according to different sects.
The Gregorian Year 2021 begins on January 1, 2021.

# CALENDAR, 2021

| Day of Month | Day of Year | Day of Week | Days since J 2021.5 | Fraction of Year since Jan. 1.0 | Julian Day (at 0h U.T.) | Indian Calendar: Day of Month | Indian Calendar: Day of Year | Phases of the Moon |
|---|---|---|---|---|---|---|---|---|
| | | | | | 2459 | 1942 Saka Era | | |
| Dec. 27 | 362 | Sun | -187.375 | -0.0110 | 210.5 | Pausha 6 | 282 | |
| 28 | 363 | Mon | 186.375 | -0.0082 | 211.5 | 7 | 283 | |
| 29 | 364 | Tue | 185.375 | -0.0055 | 212.5 | 8 | 284 | |
| 30 | 365 | Wed | 184.375 | -0.0027 | 213.5 | 9 | 285 | 30-Full Moon |
| Dec. 31 | 366 | Thu | 183.375 | 0.0000 | 214.5 | 10 | 286 | 03$^h$ 28$^m$ U.T. |
| Jan. 1 | 1 | Fri | 182.375 | 0.0027 | 215.5 | 11 | 287 | |
| 2 | 2 | Sat | 181.375 | 0.0055 | 216.5 | 12 | 288 | |
| 3 | 3 | Sun | -180.375 | 0.0082 | 217.5 | 13 | 289 | |
| 4 | 4 | Mon | 179.375 | 0.0110 | 218.5 | 14 | 290 | |
| 5 | 5 | Tue | 178.375 | 0.0137 | 219.5 | 15 | 291 | |
| 6 | 6 | Wed | 177.375 | 0.0164 | 220.5 | 16 | 292 | 06-Last Quarter |
| 7 | 7 | Thu | 176.375 | 0.0192 | 221.5 | 17 | 293 | 09$^h$ 37$^m$ U.T. |
| 8 | 8 | Fri | 175.375 | 0.0219 | 222.5 | 18 | 294 | |
| 9 | 9 | Sat | 174.375 | 0.0246 | 223.5 | 19 | 295 | |
| 10 | 10 | Sun | -173.375 | 0.0274 | 224.5 | 20 | 296 | |
| 11 | 11 | Mon | 172.375 | 0.0301 | 225.5 | 21 | 297 | |
| 12 | 12 | Tue | 171.375 | 0.0329 | 226.5 | 22 | 298 | |
| 13 | 13 | Wed | 170.375 | 0.0356 | 227.5 | 23 | 299 | 13-New Moon |
| 14 | 14 | Thu | 169.375 | 0.0383 | 228.5 | 24 | 300 | 05$^h$ 00$^m$ U.T. |
| 15 | 15 | Fri | 168.375 | 0.0411 | 229.5 | 25 | 301 | |
| 16 | 16 | Sat | 167.375 | 0.0438 | 230.5 | 26 | 302 | |
| 17 | 17 | Sun | -166.375 | 0.0465 | 231.5 | 27 | 303 | |
| 18 | 18 | Mon | 165.375 | 0.0493 | 232.5 | 28 | 304 | |
| 19 | 19 | Tue | 164.375 | 0.0520 | 233.5 | 29 | 305 | |
| 20 | 20 | Wed | 163.375 | 0.0548 | 234.5 | 30 | 306 | 20-First Quarter |
| 21 | 21 | Thu | 162.375 | 0.0575 | 235.5 | Magha 1 | 307 | 21$^h$ 02$^m$ U.T. |
| 22 | 22 | Fri | 161.375 | 0.0602 | 236.5 | 2 | 308 | |
| 23 | 23 | Sat | 160.375 | 0.0630 | 237.5 | 3 | 309 | |
| 24 | 24 | Sun | -159.375 | 0.0657 | 238.5 | 4 | 310 | |
| 25 | 25 | Mon | 158.375 | 0.0684 | 239.5 | 5 | 311 | |
| 26 | 26 | Tue | 157.375 | 0.0712 | 240.5 | 6 | 312 | |
| 27 | 27 | Wed | 156.375 | 0.0739 | 241.5 | 7 | 313 | |
| 28 | 28 | Thu | 155.375 | 0.0767 | 242.5 | 8 | 314 | 28-Full Moon |
| 29 | 29 | Fri | 154.375 | 0.0794 | 243.5 | 9 | 315 | 19$^h$ 16$^m$ U.T. |
| 30 | 30 | Sat | 153.375 | 0.0821 | 244.5 | 10 | 316 | |
| 31 | 31 | Sun | -152.375 | 0.0849 | 245.5 | 11 | 317 | |
| Feb. 1 | 32 | Mon | 151.375 | 0.0876 | 246.5 | 12 | 318 | |
| 2 | 33 | Tue | 150.375 | 0.0904 | 247.5 | 13 | 319 | |
| 3 | 34 | Wed | 149.375 | 0.0931 | 248.5 | 14 | 320 | |
| 4 | 35 | Thu | 148.375 | 0.0958 | 249.5 | 15 | 321 | 04-Last Quarter |
| 5 | 36 | Fri | 147.375 | 0.0986 | 250.5 | 16 | 322 | 17$^h$ 37$^m$ U.T. |
| 6 | 37 | Sat | -146.375 | 0.1013 | 251.5 | 17 | 323 | |

## CALENDAR, 2021

| Day of Month | | Day of Year | Day of Week | Days since J 2021.5 | Fraction of Year since Jan. 1.0 | Julian Day (at 0h U.T.) | Indian Calendar Day of Month | Indian Calendar Day of Year | Phases of the Moon |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 2459 | 1942 Saka Era | | |
| Feb. | 7 | 38 | Sun | -145.375 | 0.1040 | 252.5 | 18 | 324 | |
| | 8 | 39 | Mon | 144.375 | 0.1068 | 253.5 | 19 | 325 | |
| | 9 | 40 | Tue | 143.375 | 0.1095 | 254.5 | 20 | 326 | |
| | 10 | 41 | Wed | 142.375 | 0.1123 | 255.5 | 21 | 327 | |
| | 11 | 42 | Thu | 141.375 | 0.1150 | 256.5 | 22 | 328 | 11-New Moon |
| | 12 | 43 | Fri | 140.375 | 0.1177 | 257.5 | 23 | 329 | $19^h$ $06^m$ U.T. |
| | 13 | 44 | Sat | 139.375 | 0.1205 | 258.5 | 24 | 330 | |
| | 14 | 45 | Sun | -138.375 | 0.1232 | 259.5 | 25 | 331 | |
| | 15 | 46 | Mon | 137.375 | 0.1259 | 260.5 | 26 | 332 | |
| | 16 | 47 | Tue | 136.375 | 0.1287 | 261.5 | 27 | 333 | |
| | 17 | 48 | Wed | 135.375 | 0.1314 | 262.5 | 28 | 334 | |
| | 18 | 49 | Thu | 134.375 | 0.1342 | 263.5 | 29 | 335 | |
| | 19 | 50 | Fri | 133.375 | 0.1369 | 264.5 | 30 | 336 | 19-First Quarter |
| | 20 | 51 | Sat | 132.375 | 0.1396 | 265.5 | Phalguna 1 | 337 | $18^h$ $47^m$ U.T. |
| | 21 | 52 | Sun | -131.375 | 0.1424 | 266.5 | 2 | 338 | |
| | 22 | 53 | Mon | 130.375 | 0.1451 | 267.5 | 3 | 339 | |
| | 23 | 54 | Tue | 129.375 | 0.1478 | 268.5 | 4 | 340 | |
| | 24 | 55 | Wed | 128.375 | 0.1506 | 269.5 | 5 | 341 | |
| | 25 | 56 | Thu | 127.375 | 0.1533 | 270.5 | 6 | 342 | |
| | 26 | 57 | Fri | 126.375 | 0.1561 | 271.5 | 7 | 343 | |
| | 27 | 58 | Sat | 125.375 | 0.1588 | 272.5 | 8 | 344 | 27-Full Moon $08^h$ $17^m$ U.T. |
| | 28 | 59 | Sun | -124.375 | 0.1615 | 273.5 | 9 | 345 | |
| Mar. | 1 | 60 | Mon | 123.375 | 0.1643 | 274.5 | 10 | 346 | |
| | 2 | 61 | Tue | 122.375 | 0.1670 | 275.5 | 11 | 347 | |
| | 3 | 62 | Wed | 121.375 | 0.1698 | 276.5 | 12 | 348 | |
| | 4 | 63 | Thu | 120.375 | 0.1725 | 277.5 | 13 | 349 | |
| | 5 | 64 | Fri | 119.375 | 0.1752 | 278.5 | 14 | 350 | |
| | 6 | 65 | Sat | 118.375 | 0.1780 | 279.5 | 15 | 351 | 06-Last Quarter $01^h$ $30^m$ U.T. |
| | 7 | 66 | Sun | -117.375 | 0.1807 | 280.5 | 16 | 352 | |
| | 8 | 67 | Mon | 116.375 | 0.1834 | 281.5 | 17 | 353 | |
| | 9 | 68 | Tue | 115.375 | 0.1862 | 282.5 | 18 | 354 | |
| | 10 | 69 | Wed | 114.375 | 0.1889 | 283.5 | 19 | 355 | |
| | 11 | 70 | Thu | 113.375 | 0.1917 | 284.5 | 20 | 356 | |
| | 12 | 71 | Fri | 112.375 | 0.1944 | 285.5 | 21 | 357 | |
| | 13 | 72 | Sat | 111.375 | 0.1971 | 286.5 | 22 | 358 | 13-New Moon $10^h$ $21^m$ U.T. |
| | 14 | 73 | Sun | -110.375 | 0.1999 | 287.5 | 23 | 359 | |
| | 15 | 74 | Mon | 109.375 | 0.2026 | 288.5 | 24 | 360 | |
| | 16 | 75 | Tue | 108.375 | 0.2053 | 289.5 | 25 | 361 | |
| | 17 | 76 | Wed | 107.375 | 0.2081 | 290.5 | 26 | 362 | |
| | 18 | 77 | Thu | 106.375 | 0.2108 | 291.5 | 27 | 363 | |
| | 19 | 78 | Fri | 105.375 | 0.2136 | 292.5 | 28 | 364 | |
| | 20 | 79 | Sat | -104.375 | 0.2163 | 293.5 | 29 | 365 | |

# CALENDAR, 2021

| Day of Month | Day of Year | Day of Week | Days since J 2021.5 | Fraction of Year since Jan. 1.0 | Julian Day (at 0h U.T.) | Indian Calendar Day of Month | Indian Calendar Day of Year | Phases of the Moon |
|---|---|---|---|---|---|---|---|---|
| | | | | | 2459 | 1942 Saka Era | | |
| Mar. 21 | 80 | Sun | -103.375 | 0.2190 | 294.5 | 30 | 366 | 21-First Quarter |
| 22 | 81 | Mon | 102.375 | 0.2218 | 295.5 | 1943, Chaitra 1 | 1 | $14^h$ $40^m$ U.T. |
| 23 | 82 | Tue | 101.375 | 0.2245 | 296.5 | 2 | 2 | |
| 24 | 83 | Wed | 100.375 | 0.2272 | 297.5 | 3 | 3 | |
| 25 | 84 | Thu | 99.375 | 0.2300 | 298.5 | 4 | 4 | |
| 26 | 85 | Fri | 98.375 | 0.2327 | 299.5 | 5 | 5 | |
| 27 | 86 | Sat | 97.375 | 0.2355 | 300.5 | 6 | 6 | |
| 28 | 87 | Sun | -96.375 | 0.2382 | 301.5 | 7 | 7 | 28-Full Moon |
| 29 | 88 | Mon | 95.375 | 0.2409 | 302.5 | 8 | 8 | $18^h$ $48^m$ U.T. |
| 30 | 89 | Tue | 94.375 | 0.2437 | 303.5 | 9 | 9 | |
| 31 | 90 | Wed | 93.375 | 0.2464 | 304.5 | 10 | 10 | |
| Apr. 1 | 91 | Thu | 92.375 | 0.2491 | 305.5 | 11 | 11 | |
| 2 | 92 | Fri | 91.375 | 0.2519 | 306.5 | 12 | 12 | |
| 3 | 93 | Sat | 90.375 | 0.2546 | 307.5 | 13 | 13 | |
| 4 | 94 | Sun | -89.375 | 0.2574 | 308.5 | 14 | 14 | 04-Last Quarter |
| 5 | 95 | Mon | 88.375 | 0.2601 | 309.5 | 15 | 15 | $10^h$ $02^m$ U.T. |
| 6 | 96 | Tue | 87.375 | 0.2628 | 310.5 | 16 | 16 | |
| 7 | 97 | Wed | 86.375 | 0.2656 | 311.5 | 17 | 17 | |
| 8 | 98 | Thu | 85.375 | 0.2683 | 312.5 | 18 | 18 | |
| 9 | 99 | Fri | 84.375 | 0.2711 | 313.5 | 19 | 19 | |
| 10 | 100 | Sat | 83.375 | 0.2738 | 314.5 | 20 | 20 | |
| 11 | 101 | Sun | -82.375 | 0.2765 | 315.5 | 21 | 21 | |
| 12 | 102 | Mon | 81.375 | 0.2793 | 316.5 | 22 | 22 | 12-New Moon |
| 13 | 103 | Tue | 80.375 | 0.2820 | 317.5 | 23 | 23 | $02^h$ $31^m$ U.T. |
| 14 | 104 | Wed | 79.375 | 0.2847 | 318.5 | 24 | 24 | |
| 15 | 105 | Thu | 78.375 | 0.2875 | 319.5 | 25 | 25 | |
| 16 | 106 | Fri | 77.375 | 0.2902 | 320.5 | 26 | 26 | |
| 17 | 107 | Sat | 76.375 | 0.2930 | 321.5 | 27 | 27 | |
| 18 | 108 | Sun | -75.375 | 0.2957 | 322.5 | 28 | 28 | |
| 19 | 109 | Mon | 74.375 | 0.2984 | 323.5 | 29 | 29 | |
| 20 | 110 | Tue | 73.375 | 0.3012 | 324.5 | 30 | 30 | 20-First Quarter |
| 21 | 111 | Wed | 72.375 | 0.3039 | 325.5 | Vaisakha 1 | 31 | $06^h$ $59^m$ U.T. |
| 22 | 112 | Thu | 71.375 | 0.3066 | 326.5 | 2 | 32 | |
| 23 | 113 | Fri | 70.375 | 0.3094 | 327.5 | 3 | 33 | |
| 24 | 114 | Sat | 69.375 | 0.3121 | 328.5 | 4 | 34 | |
| 25 | 115 | Sun | -68.375 | 0.3149 | 329.5 | 5 | 35 | |
| 26 | 116 | Mon | 67.375 | 0.3176 | 330.5 | 6 | 36 | |
| 27 | 117 | Tue | 66.375 | 0.3203 | 331.5 | 7 | 37 | 27-Full Moon |
| 28 | 118 | Wed | 65.375 | 0.3231 | 332.5 | 8 | 38 | $03^h$ $31^m$ U.T. |
| 29 | 119 | Thu | 64.375 | 0.3258 | 333.5 | 9 | 39 | |
| 30 | 120 | Fri | 63.375 | 0.3285 | 334.5 | 10 | 40 | |
| May 1 | 121 | Sat | -62.375 | 0.3313 | 335.5 | 11 | 41 | |

## CALENDAR, 2021

| Day of Month | | Day of Year | Day of Week | Days since J 2021.5 | Fraction of Year since Jan. 1.0 | Julian Day (at 0h U.T.) | Indian Calendar: Day of Month | Indian Calendar: Day of Year | Phases of the Moon |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 2459 | 1943 Saka Era | | |
| May | 2 | 122 | Sun | -61.375 | 0.3340 | 336.5 | Vaisakha 12 | 43 | |
| | 3 | 123 | Mon | 60.375 | 0.3368 | 337.5 | 13 | 44 | 03-Last Quarter |
| | 4 | 124 | Tue | 59.375 | 0.3395 | 338.5 | 14 | 45 | $19^h\ 50^m$ U.T. |
| | 5 | 125 | Wed | 58.375 | 0.3422 | 339.5 | 15 | 46 | |
| | 6 | 126 | Thu | 57.375 | 0.3450 | 340.5 | 16 | 47 | |
| | 7 | 127 | Fri | 56.375 | 0.3477 | 341.5 | 17 | 48 | |
| | 8 | 128 | Sat | 55.375 | 0.3505 | 342.5 | 18 | 49 | |
| | 9 | 129 | Sun | -54.375 | 0.3532 | 343.5 | 19 | 50 | |
| | 10 | 130 | Mon | 53.375 | 0.3559 | 344.5 | 20 | 51 | |
| | 11 | 131 | Tue | 52.375 | 0.3587 | 345.5 | 21 | 52 | 11-New Moon |
| | 12 | 132 | Wed | 51.375 | 0.3614 | 346.5 | 22 | 53 | $19^h\ 00^m$ U.T. |
| | 13 | 133 | Thu | 50.375 | 0.3641 | 347.5 | 23 | 54 | |
| | 14 | 134 | Fri | 49.375 | 0.3669 | 348.5 | 24 | 55 | |
| | 15 | 135 | Sat | 48.375 | 0.3696 | 349.5 | 25 | 56 | |
| | 16 | 136 | Sun | -47.375 | 0.3724 | 350.5 | 26 | 57 | |
| | 17 | 137 | Mon | 46.375 | 0.3751 | 351.5 | 27 | 58 | |
| | 18 | 138 | Tue | 45.375 | 0.3778 | 352.5 | 28 | 59 | |
| | 19 | 139 | Wed | 44.375 | 0.3806 | 353.5 | 29 | 60 | 19-First Quarter |
| | 20 | 140 | Thu | 43.375 | 0.3833 | 354.5 | 30 | 61 | $19^h\ 13^m$ U.T. |
| | 21 | 141 | Fri | 42.375 | 0.3860 | 355.5 | 31 | 62 | |
| | 22 | 142 | Sat | 41.375 | 0.3888 | 356.5 | Jyaistha 1 | 63 | |
| | 23 | 143 | Sun | -40.375 | 0.3915 | 357.5 | 2 | 64 | |
| | 24 | 144 | Mon | 39.375 | 0.3943 | 358.5 | 3 | 65 | |
| | 25 | 145 | Tue | 38.375 | 0.3970 | 359.5 | 4 | 66 | |
| | 26 | 146 | Wed | 37.375 | 0.3997 | 360.5 | 5 | 67 | 26-Full Moon |
| | 27 | 147 | Thu | 36.375 | 0.4025 | 361.5 | 6 | 68 | $11^h\ 14^m$ U.T. |
| | 28 | 148 | Fri | 35.375 | 0.4052 | 362.5 | 7 | 69 | |
| | 29 | 149 | Sat | 34.375 | 0.4079 | 363.5 | 8 | 70 | |
| | 30 | 150 | Sun | -33.375 | 0.4107 | 364.5 | 9 | 71 | |
| | 31 | 151 | Mon | 32.375 | 0.4134 | 365.5 | 10 | 72 | |
| June | 1 | 152 | Tue | 31.375 | 0.4162 | 366.5 | 11 | 73 | |
| | 2 | 153 | Wed | 30.375 | 0.4189 | 367.5 | 12 | 74 | 02-Last Quarter |
| | 3 | 154 | Thu | 29.375 | 0.4216 | 368.5 | 13 | 75 | $07^h\ 24^m$ U.T. |
| | 4 | 155 | Fri | 28.375 | 0.4244 | 369.5 | 14 | 76 | |
| | 5 | 156 | Sat | 27.375 | 0.4271 | 370.5 | 15 | 77 | |
| | 6 | 157 | Sun | -26.375 | 0.4299 | 371.5 | 16 | 78 | |
| | 7 | 158 | Mon | 25.375 | 0.4326 | 372.5 | 17 | 79 | |
| | 8 | 159 | Tue | 24.375 | 0.4353 | 373.5 | 18 | 80 | |
| | 9 | 160 | Wed | 23.375 | 0.4381 | 374.5 | 19 | 81 | |
| | 10 | 161 | Thu | 22.375 | 0.4408 | 375.5 | 20 | 82 | 10-New Moon |
| | 11 | 162 | Fri | 21.375 | 0.4435 | 376.5 | 21 | 83 | $10^h\ 53^m$ U.T. |
| | 12 | 163 | Sat | -20.375 | 0.4463 | 377.5 | 22 | 84 | |

## CALENDAR, 2021

| Day of Month | Day of Year | Day of Week | Days since J 2021.5 | Fraction of Year since Jan. 1.0 | Julian Day (at 0h U.T.) | Indian Calendar: Day of Month | Indian Calendar: Day of Year | Phases of the Moon |
|---|---|---|---|---|---|---|---|---|
| | | | | | 2459 | 1943 Saka Era | | |
| June 13 | 164 | Sun | -19.375 | 0.4490 | 378.5 | Jyaishtha 23 | 85 | |
| 14 | 165 | Mon | 18.375 | 0.4518 | 379.5 | 24 | 86 | |
| 15 | 166 | Tue | 17.375 | 0.4545 | 380.5 | 25 | 87 | |
| 16 | 167 | Wed | 16.375 | 0.4572 | 381.5 | 26 | 88 | |
| 17 | 168 | Thu | 15.375 | 0.4600 | 382.5 | 27 | 89 | |
| 18 | 169 | Fri | 14.375 | 0.4627 | 383.5 | 28 | 90 | 18-First Quarter |
| 19 | 170 | Sat | 13.375 | 0.4654 | 384.5 | 29 | 91 | $03^h$ $54^m$ U.T. |
| 20 | 171 | Sun | -12.375 | -00.468 | 385.5 | 30 | 92 | |
| 21 | 172 | Mon | 11.375 | 0.4709 | 386.5 | 31 | 93 | |
| 22 | 173 | Tue | 10.375 | 0.4737 | 387.5 | Ashadha 1 | 94 | |
| 23 | 174 | Wed | 9.375 | 0.4764 | 388.5 | 2 | 95 | |
| 24 | 175 | Thu | 8.375 | 0.4791 | 389.5 | 3 | 96 | 24-Full Moon |
| 25 | 176 | Fri | 7.375 | 0.4819 | 390.5 | 4 | 97 | $18^h$ $40^m$ U.T. |
| 26 | 177 | Sat | 6.375 | 0.4846 | 391.5 | 5 | 98 | |
| 27 | 178 | Sun | -5.375 | 0.4873 | 392.5 | 6 | 99 | |
| 28 | 179 | Mon | 4.375 | 0.4901 | 393.5 | 7 | 100 | |
| 29 | 180 | Tue | 3.375 | 0.4928 | 394.5 | 8 | 101 | |
| 30 | 181 | Wed | 2.375 | 0.4956 | 395.5 | 9 | 102 | |
| July 1 | 182 | Thu | 1.375 | 0.4983 | 396.5 | 10 | 103 | 01-Last Quarter |
| 2 | 183 | Fri | -0.375 | 0.5010 | 397.5 | 11 | 104 | $21^h$ $11^m$ U.T. |
| 3 | 184 | Sat | +0.625 | 0.5038 | 398.5 | 12 | 105 | |
| 4 | 185 | Sun | +1.625 | 0.5065 | 399.5 | 13 | 106 | |
| 5 | 186 | Mon | 2.625 | 0.5093 | 400.5 | 14 | 107 | |
| 6 | 187 | Tue | 3.625 | 0.5120 | 401.5 | 15 | 108 | |
| 7 | 188 | Wed | 4.625 | 0.5147 | 402.5 | 16 | 109 | |
| 8 | 189 | Thu | 5.625 | 0.5175 | 403.5 | 17 | 110 | |
| 9 | 190 | Fri | 6.625 | 0.5202 | 404.5 | 18 | 111 | |
| 10 | 191 | Sat | 7.625 | 0.5229 | 405.5 | 19 | 112 | 10-New Moon |
| | | | | | | | | $01^h$ $17^m$ U.T. |
| 11 | 192 | Sun | +8.625 | 0.5257 | 406.5 | 20 | 113 | |
| 12 | 193 | Mon | 9.625 | 0.5284 | 407.5 | 21 | 114 | |
| 13 | 194 | Tue | 10.625 | 0.5312 | 408.5 | 22 | 115 | |
| 14 | 195 | Wed | 11.625 | 0.5339 | 409.5 | 23 | 116 | |
| 15 | 196 | Thu | 12.625 | 0.5366 | 410.5 | 24 | 117 | |
| 16 | 197 | Fri | 13.625 | 0.5394 | 411.5 | 25 | 118 | |
| 17 | 198 | Sat | 14.625 | 0.5421 | 412.5 | 26 | 119 | 17-First Quarter |
| | | | | | | | | $10^h$ $11^m$ U.T. |
| 18 | 199 | Sun | +15.625 | 0.5448 | 413.5 | 27 | 120 | |
| 19 | 200 | Mon | 16.625 | 0.5476 | 414.5 | 28 | 121 | |
| 20 | 201 | Tue | 17.625 | 0.5503 | 415.5 | 29 | 122 | |
| 21 | 202 | Wed | 18.625 | 0.5531 | 416.5 | 30 | 123 | |
| 22 | 203 | Thu | 19.625 | 0.5558 | 417.5 | 31 | 124 | |
| 23 | 204 | Fri | 20.625 | 0.5585 | 418.5 | Sravana 1 | 125 | |
| 24 | 205 | Sat | +21.625 | 0.5613 | 419.5 | 2 | 126 | 24-Full Moon |
| | | | | | | | | $02^h$ $37^m$ U.T. |

## CALENDAR, 2021

| Day of Month | | Day of Year | Day of Week | Days since J 2021.5 | Fraction of Year since Jan. 1.0 | Julian Day (at 0h U.T.) | Indian Calendar Day of Month | Indian Calendar Day of Year | Phases of the Moon |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 2459 | 1943 Saka Era | | |
| July | 25 | 206 | Sun | +22.625 | 0.5640 | 420.5 | Sravana 3 | 127 | |
| | 26 | 207 | Mon | 23.625 | 0.5667 | 421.5 | 4 | 128 | |
| | 27 | 208 | Tue | 24.625 | 0.5695 | 422.5 | 5 | 129 | |
| | 28 | 209 | Wed | 25.625 | 0.5722 | 423.5 | 6 | 130 | |
| | 29 | 210 | Thu | 26.625 | 0.5750 | 424.5 | 7 | 131 | |
| | 30 | 211 | Fri | 27.625 | 0.5777 | 425.5 | 8 | 132 | |
| | 31 | 212 | Sat | 28.625 | 0.5804 | 426.5 | 9 | 133 | 31-Last Quarter $13^h\ 16^m$ U.T. |
| Aug. | 1 | 213 | Sun | +29.625 | 0.5832 | 427.5 | 10 | 134 | |
| | 2 | 214 | Mon | 30.625 | 0.5859 | 428.5 | 11 | 135 | |
| | 3 | 215 | Tue | 31.625 | 0.5887 | 429.5 | 12 | 136 | |
| | 4 | 216 | Wed | 32.625 | 0.5914 | 430.5 | 13 | 137 | |
| | 5 | 217 | Thu | 33.625 | 0.5941 | 431.5 | 14 | 138 | |
| | 6 | 218 | Fri | 34.625 | 0.5969 | 432.5 | 15 | 139 | |
| | 7 | 219 | Sat | 35.625 | 0.5996 | 433.5 | 16 | 140 | |
| | 8 | 220 | Sun | +36.625 | 0.6023 | 434.5 | 17 | 141 | 08-New Moon $13^h\ 50^m$ U.T. |
| | 9 | 221 | Mon | 37.625 | 0.6051 | 435.5 | 18 | 142 | |
| | 10 | 222 | Tue | 38.625 | 0.6078 | 436.5 | 19 | 143 | |
| | 11 | 223 | Wed | 39.625 | 0.6106 | 437.5 | 20 | 144 | |
| | 12 | 224 | Thu | 40.625 | 0.6133 | 438.5 | 21 | 145 | |
| | 13 | 225 | Fri | 41.625 | 0.6160 | 439.5 | 22 | 146 | |
| | 14 | 226 | Sat | 42.625 | 0.6188 | 440.5 | 23 | 147 | |
| | 15 | 227 | Sun | +43.625 | 0.6215 | 441.5 | 24 | 148 | 15-First Quarter $15^h\ 20^m$ U.T. |
| | 16 | 228 | Mon | 44.625 | 0.6242 | 442.5 | 25 | 149 | |
| | 17 | 229 | Tue | 45.625 | 0.6270 | 443.5 | 26 | 150 | |
| | 18 | 230 | Wed | 46.625 | 0.6297 | 444.5 | 27 | 151 | |
| | 19 | 231 | Thu | 47.625 | 0.6325 | 445.5 | 28 | 152 | |
| | 20 | 232 | Fri | 48.625 | 0.6352 | 446.5 | 29 | 153 | |
| | 21 | 233 | Sat | 49.625 | 0.6379 | 447.5 | 30 | 154 | |
| | 22 | 234 | Sun | +50.625 | 0.6407 | 448.5 | 31 | 155 | 22-Full Moon $12^h\ 02^m$ U.T. |
| | 23 | 235 | Mon | 51.625 | 0.6434 | 449.5 | Bhadra 1 | 156 | |
| | 24 | 236 | Tue | 52.625 | 0.6461 | 450.5 | 2 | 157 | |
| | 25 | 237 | Wed | 53.625 | 0.6489 | 451.5 | 3 | 158 | |
| | 26 | 238 | Thu | 54.625 | 0.6516 | 452.5 | 4 | 159 | |
| | 27 | 239 | Fri | 55.625 | 0.6544 | 453.5 | 5 | 160 | |
| | 28 | 240 | Sat | 56.625 | 0.6571 | 454.5 | 6 | 161 | |
| | 29 | 241 | Sun | +57.625 | 0.6598 | 455.5 | 7 | 162 | |
| | 30 | 242 | Mon | 58.625 | 0.6626 | 456.5 | 8 | 163 | 30-Last Quarter $07^h\ 13^m$ U.T. |
| | 31 | 243 | Tue | 59.625 | 0.6653 | 457.5 | 9 | 164 | |
| Sept. | 1 | 244 | Wed | 60.625 | 0.6680 | 458.5 | 10 | 165 | |
| | 2 | 245 | Thu | 61.625 | 0.6708 | 459.5 | 11 | 166 | |
| | 3 | 246 | Fri | 62.625 | 0.6735 | 460.5 | 12 | 167 | |
| | 4 | 247 | Sat | +63.625 | 0.6763 | 461.5 | 13 | 168 | |

# CALENDAR, 2021

| Day of Month | Day of Year | Day of Week | Days since J 2021.5 | Fraction of Year since Jan. 1.0 | Julian Day (at 0h U.T.) | Indian Calendar Day of Month | Indian Calendar Day of Year | Phases of the Moon |
|---|---|---|---|---|---|---|---|---|
| | | | | | 2459 | 1943 Saka Era | | |
| Sept. 5 | 248 | Sun | +64.625 | 0.6790 | 462.5 | Bhadra 14 | 169 | |
| 6 | 249 | Mon | 65.625 | 0.6817 | 463.5 | 15 | 170 | |
| 7 | 250 | Tue | 66.625 | 0.6845 | 464.5 | 16 | 171 | 07-New Moon |
| 8 | 251 | Wed | 67.625 | 0.6872 | 465.5 | 17 | 172 | $00^h$ $52^m$ U.T. |
| 9 | 252 | Thu | 68.625 | 0.6900 | 466.5 | 18 | 173 | |
| 10 | 253 | Fri | 69.625 | 0.6927 | 467.5 | 19 | 174 | |
| 11 | 254 | Sat | 70.625 | 0.6954 | 468.5 | 20 | 175 | |
| 12 | 255 | Sun | +71.625 | 0.6982 | 469.5 | 21 | 176 | |
| 13 | 256 | Mon | 72.625 | 0.7009 | 470.5 | 22 | 177 | 13-First Quarter |
| 14 | 257 | Tue | 73.625 | 0.7036 | 471.5 | 23 | 178 | $20^h$ $39^m$ U.T. |
| 15 | 258 | Wed | 74.625 | 0.7064 | 472.5 | 24 | 179 | |
| 16 | 259 | Thu | 75.625 | 0.7091 | 473.5 | 25 | 180 | |
| 17 | 260 | Fri | 76.625 | 0.7119 | 474.5 | 26 | 181 | |
| 18 | 261 | Sat | 77.625 | 0.7146 | 475.5 | 27 | 182 | |
| 19 | 262 | Sun | +78.625 | 0.7173 | 476.5 | 28 | 183 | |
| 20 | 263 | Mon | 79.625 | 0.7201 | 477.5 | 29 | 184 | 20-Full Moon |
| 21 | 264 | Tue | 80.625 | 0.7228 | 478.5 | 30 | 185 | $23^h$ $55^m$ U.T. |
| 22 | 265 | Wed | 81.625 | 0.7255 | 479.5 | 31 | 186 | |
| 23 | 266 | Thu | 82.625 | 0.7283 | 480.5 | Asvina 1 | 187 | |
| 24 | 267 | Fri | 83.625 | 0.7310 | 481.5 | 2 | 188 | |
| 25 | 268 | Sat | 84.625 | 0.7338 | 482.5 | 3 | 189 | |
| 26 | 269 | Sun | +85.625 | 0.7365 | 483.5 | 4 | 190 | |
| 27 | 270 | Mon | 86.625 | 0.7392 | 484.5 | 5 | 191 | |
| 28 | 271 | Tue | 87.625 | 0.7420 | 485.5 | 6 | 192 | |
| 29 | 272 | Wed | 88.625 | 0.7447 | 486.5 | 7 | 193 | 29-Last Quarter |
| 30 | 273 | Thu | 89.625 | 0.7474 | 487.5 | 8 | 194 | $01^h$ $57^m$ U.T. |
| Oct. 1 | 274 | Fri | 90.625 | 0.7502 | 488.5 | 9 | 195 | |
| 2 | 275 | Sat | 91.625 | 0.7529 | 489.5 | 10 | 196 | |
| 3 | 276 | Sun | +92.625 | 0.7557 | 490.5 | 11 | 197 | |
| 4 | 277 | Mon | 93.625 | 0.7584 | 491.5 | 12 | 198 | |
| 5 | 278 | Tue | 94.625 | 0.7611 | 492.5 | 13 | 199 | |
| 6 | 279 | Wed | 95.625 | 0.7639 | 493.5 | 14 | 200 | 06-New Moon |
| 7 | 280 | Thu | 96.625 | 0.7666 | 494.5 | 15 | 201 | $11^h$ $05^m$ U.T. |
| 8 | 281 | Fri | 97.625 | 0.7694 | 495.5 | 16 | 202 | |
| 9 | 282 | Sat | 98.625 | 0.7721 | 496.5 | 17 | 203 | |
| 10 | 283 | Sun | +99.625 | 0.7748 | 497.5 | 18 | 204 | |
| 11 | 284 | Mon | 100.625 | 0.7776 | 498.5 | 19 | 205 | |
| 12 | 285 | Tue | 101.625 | 0.7803 | 499.5 | 20 | 206 | |
| 13 | 286 | Wed | 102.625 | 0.7830 | 500.5 | 21 | 207 | 13-First Quarter |
| 14 | 287 | Thu | 103.625 | 0.7858 | 501.5 | 22 | 208 | $03^h$ $25^m$ U.T. |
| 15 | 288 | Fri | 104.625 | 0.7885 | 502.5 | 23 | 209 | |
| 16 | 289 | Sat | +105.625 | 0.7913 | 503.5 | 24 | 210 | |

## CALENDAR, 2021

| Day of Month | Day of Year | Day of Week | Days since J 2021.5 | Fraction of Year since Jan. 1.0 | Julian Day (at 0h U.T.) | Indian Calendar: Day of Month | Indian Calendar: Day of Year | Phases of the Moon |
|---|---|---|---|---|---|---|---|---|
| | | | | | 2459 | 1943 Saka Era | | |
| Oct. 17 | 290 | Sun | +106.625 | 0.7940 | 504.5 | Asvina 25 | 211 | |
| 18 | 291 | Mon | 107.625 | 0.7967 | 505.5 | 26 | 212 | |
| 19 | 292 | Tue | 108.625 | 0.7995 | 506.5 | 27 | 213 | |
| 20 | 293 | Wed | 109.625 | 0.8022 | 507.5 | 28 | 214 | 20-Full Moon |
| 21 | 294 | Thu | 110.625 | 0.8049 | 508.5 | 29 | 215 | $14^h\ 57^m$ U.T. |
| 22 | 295 | Fri | 111.625 | 0.8077 | 509.5 | 30 | 216 | |
| 23 | 296 | Sat | 112.625 | 0.8104 | 510.5 | Kartika 1 | 217 | |
| 24 | 297 | Sun | +113.625 | 0.8132 | 511.5 | 2 | 218 | |
| 25 | 298 | Mon | 114.625 | 0.8159 | 512.5 | 3 | 219 | |
| 26 | 299 | Tue | 115.625 | 0.8186 | 513.5 | 4 | 220 | |
| 27 | 300 | Wed | 116.625 | 0.8214 | 514.5 | 5 | 221 | |
| 28 | 301 | Thu | 117.625 | 0.8241 | 515.5 | 6 | 222 | 28-Last Quarter |
| 29 | 302 | Fri | 118.625 | 0.8268 | 516.5 | 7 | 223 | $20^h\ 05^m$ U.T. |
| 30 | 303 | Sat | 119.625 | 0.8296 | 517.5 | 8 | 224 | |
| 31 | 304 | Sun | +120.625 | 0.8323 | 518.5 | 9 | 225 | |
| Nov. 1 | 305 | Mon | 121.625 | 0.8351 | 519.5 | 10 | 226 | |
| 2 | 306 | Tue | 122.625 | 0.8378 | 520.5 | 11 | 227 | |
| 3 | 307 | Wed | 123.625 | 0.8405 | 521.5 | 12 | 228 | |
| 4 | 308 | Thu | 124.625 | 0.8433 | 522.5 | 13 | 229 | 04-New Moon |
| 5 | 309 | Fri | 125.625 | 0.8460 | 523.5 | 14 | 230 | $21^h\ 15^m$ U.T. |
| 6 | 310 | Sat | 126.625 | 0.8488 | 524.5 | 15 | 231 | |
| 7 | 311 | Sun | +127.625 | 0.8515 | 525.5 | 16 | 232 | |
| 8 | 312 | Mon | 128.625 | 0.8542 | 526.5 | 17 | 233 | |
| 9 | 313 | Tue | 129.625 | 0.8570 | 527.5 | 18 | 234 | |
| 10 | 314 | Wed | 130.625 | 0.8597 | 528.5 | 19 | 235 | |
| 11 | 315 | Thu | 131.625 | 0.8624 | 529.5 | 20 | 236 | 11-First Quarter |
| 12 | 316 | Fri | 132.625 | 0.8652 | 530.5 | 21 | 237 | $12^h\ 46^m$ U.T. |
| 13 | 317 | Sat | 133.625 | 0.8679 | 531.5 | 22 | 238 | |
| 14 | 318 | Sun | +134.625 | 0.8707 | 532.5 | 23 | 239 | |
| 15 | 319 | Mon | 135.625 | 0.8734 | 533.5 | 24 | 240 | |
| 16 | 320 | Tue | 136.625 | 0.8761 | 534.5 | 25 | 241 | |
| 17 | 321 | Wed | 137.625 | 0.8789 | 535.5 | 26 | 242 | |
| 18 | 322 | Thu | 138.625 | 0.8816 | 536.5 | 27 | 243 | |
| 19 | 323 | Fri | 139.625 | 0.8843 | 537.5 | 28 | 244 | 19-Full Moon |
| 20 | 324 | Sat | 140.625 | 0.8871 | 538.5 | 29 | 245 | $08^h\ 57^m$ U.T. |
| 21 | 325 | Sun | +141.625 | 0.8898 | 539.5 | 30 | 246 | |
| 22 | 326 | Mon | 142.625 | 0.8926 | 540.5 | Agrahayana 1 | 247 | |
| 23 | 327 | Tue | 143.625 | 0.8953 | 541.5 | 2 | 248 | |
| 24 | 328 | Wed | 144.625 | 0.8980 | 542.5 | 3 | 249 | |
| 25 | 329 | Thu | 145.625 | 0.9008 | 543.5 | 4 | 250 | |
| 26 | 330 | Fri | 146.625 | 0.9035 | 544.5 | 5 | 251 | |
| 27 | 331 | Sat | +147.625 | 0.9062 | 545.5 | 6 | 252 | 27-Last Quarter |
| | | | | | | | | $12^h\ 28^m$ U.T. |

## CALENDAR, 2021

| Day of Month | | Day of Year | Day of Week | Days since J 2021.5 | Fraction of Year since Jan. 1.0 | Julian Day (at 0h U.T.) | Indian Calendar Day of Month | Indian Calendar Day of Year | Phases of the Moon |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 2459 | 1943 Saka Era | | |
| Nov. | 28 | 332 | Sun | +148.625 | 0.9090 | 546.5 | Agrahayana 7 | 253 | |
| | 29 | 333 | Mon | 149.625 | 0.9117 | 547.5 | 8 | 254 | |
| | 30 | 334 | Tue | 150.625 | 0.9145 | 548.5 | 9 | 255 | |
| Dec. | 1 | 335 | Wed | 151.625 | 0.9172 | 549.5 | 10 | 256 | |
| | 2 | 336 | Thu | 152.625 | 0.9199 | 550.5 | 11 | 257 | |
| | 3 | 337 | Fri | 153.625 | 0.9227 | 551.5 | 12 | 258 | |
| | 4 | 338 | Sat | 154.625 | 0.9254 | 552.5 | 13 | 259 | 04-New Moon $07^h 43^m$ U.T. |
| | 5 | 339 | Sun | +155.625 | 0.9282 | 553.5 | 14 | 260 | |
| | 6 | 340 | Mon | 156.625 | 0.9309 | 554.5 | 15 | 261 | |
| | 7 | 341 | Tue | 157.625 | 0.9336 | 555.5 | 16 | 262 | |
| | 8 | 342 | Wed | 158.625 | 0.9364 | 556.5 | 17 | 263 | |
| | 9 | 343 | Thu | 159.625 | 0.9391 | 557.5 | 18 | 264 | |
| | 10 | 344 | Fri | 160.625 | 0.9418 | 558.5 | 19 | 265 | |
| | 11 | 345 | Sat | 161.625 | 0.9446 | 559.5 | 20 | 266 | 11-First Quarter $01^h 36^m$ U.T. |
| | 12 | 346 | Sun | +162.625 | 0.9473 | 560.5 | 21 | 267 | |
| | 13 | 347 | Mon | 163.625 | 0.9501 | 561.5 | 22 | 268 | |
| | 14 | 348 | Tue | 164.625 | 0.9528 | 562.5 | 23 | 269 | |
| | 15 | 349 | Wed | 165.625 | 0.9555 | 563.5 | 24 | 270 | |
| | 16 | 350 | Thu | 166.625 | 0.9583 | 564.5 | 25 | 271 | |
| | 17 | 351 | Fri | 167.625 | 0.9610 | 565.5 | 26 | 272 | |
| | 18 | 352 | Sat | 168.625 | 0.9637 | 566.5 | 27 | 273 | |
| | 19 | 353 | Sun | +169.625 | 0.9665 | 567.5 | 28 | 274 | 19-Full Moon |
| | 20 | 354 | Mon | 170.625 | 0.9692 | 568.5 | 29 | 275 | $04^h 35^m$ U.T. |
| | 21 | 355 | Tue | 171.625 | 0.9720 | 569.5 | 30 | 276 | |
| | 22 | 356 | Wed | 172.625 | 0.9747 | 570.5 | Pausha 1 | 277 | |
| | 23 | 357 | Thu | 173.625 | 0.9774 | 571.5 | 2 | 278 | |
| | 24 | 358 | Fri | 174.625 | 0.9802 | 572.5 | 3 | 279 | |
| | 25 | 359 | Sat | 175.625 | 0.9829 | 573.5 | 4 | 280 | |
| | 26 | 360 | Sun | +176.625 | 0.9856 | 574.5 | 5 | 281 | |
| | 27 | 361 | Mon | 177.625 | 0.9884 | 575.5 | 6 | 282 | 27-Last Quarter |
| | 28 | 362 | Tue | 178.625 | 0.9911 | 576.5 | 7 | 283 | $02^h 24^m$ U.T. |
| | 29 | 363 | Wed | 179.625 | 0.9939 | 577.5 | 8 | 284 | |
| | 30 | 364 | Thu | 180.625 | 0.9966 | 578.5 | 9 | 285 | |
| | 31 | 365 | Fri | 181.625 | 0.9993 | 579.5 | 10 | 286 | |
| | 32 | 366 | Sat | +182.625 | 1.0021 | 580.5 | 11 | 287 | |

The new epoch is the middle of the Julian year, denoted by J 2021.5 (i.e. 2021, July 2.375) where the length of the Julian year is taken to be 365.25 days.

The Fraction of year is reckoned from January 1, $0^h$ U.T and is based on the tropical year of 365.2422 days. The Julian Day begins at noon. In order to obtain the Julian Day Number completed at noon as given in Table IX, increase the above figure by 0.5.

The Day of year of the Gregorian Calendar is reckoned from January 1, and that of the Indian Calendar from Chaitra 1.

## SIDEREAL TIME, 2021

| Date | | Mean Greenwich Sidereal Time at $0^h$ U.T. (G.H.A. of the Equinox) | | | Equation of the Equinoxes at $0^h$ U.T. | Greenwich Transit of Mean Equinox (U.T. at $0^h$ G.M.S.T.) | | | Date | | Mean Greenwich Sidereal Time at $0^h$ U.T. (G.H.A. of the Equinox) | | | Equation of the Equinoxes at $0^h$ U.T. | Greenwich Transit of Mean Equinox (U.T. at $0^h$ G.M.S.T.) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | s | h | m | s | | | h | m | s | s | h | m | s |
| Jan | 0 | 6 | 39 | 31.944 | -0.996 | 17 | 17 | 37.601 | Feb | 15 | 9 | 40 | 53.491 | -0.934 | 14 | 16 | 45.765 |
| | 1 | 6 | 43 | 28.499 | 0.988 | 17 | 13 | 41.691 | | 16 | 9 | 44 | 50.046 | 0.941 | 14 | 12 | 49.856 |
| | 2 | 6 | 47 | 25.055 | 0.983 | 17 | 09 | 45.782 | | 17 | 9 | 48 | 46.602 | 0.948 | 14 | 08 | 53.946 |
| | 3 | 6 | 51 | 21.610 | 0.981 | 17 | 05 | 49.872 | | 18 | 9 | 52 | 43.157 | 0.953 | 14 | 04 | 58.037 |
| | 4 | 6 | 55 | 18.165 | 0.981 | 17 | 01 | 53.963 | | 19 | 9 | 56 | 39.712 | 0.955 | 14 | 01 | 02.127 |
| | 5 | 6 | 59 | 14.721 | 0.984 | 16 | 57 | 58.053 | | 20 | 10 | 00 | 36.268 | 0.956 | 13 | 57 | 06.218 |
| | 6 | 7 | 03 | 11.276 | -0.988 | 16 | 54 | 02.144 | | 21 | 10 | 04 | 32.823 | -0.954 | 13 | 53 | 10.308 |
| | 7 | 7 | 07 | 07.831 | 0.991 | 16 | 50 | 06.234 | | 22 | 10 | 08 | 29.378 | 0.950 | 13 | 49 | 14.399 |
| | 8 | 7 | 11 | 04.387 | 0.992 | 16 | 46 | 10.325 | | 23 | 10 | 12 | 25.934 | 0.946 | 13 | 45 | 18.489 |
| | 9 | 7 | 14 | 60.942 | 0.990 | 16 | 42 | 14.415 | | 24 | 10 | 16 | 22.489 | 0.942 | 13 | 41 | 22.580 |
| | 10 | 7 | 18 | 57.497 | 0.983 | 16 | 38 | 18.506 | | 25 | 10 | 20 | 19.044 | 0.939 | 13 | 37 | 26.670 |
| | 11 | 7 | 22 | 54.053 | 0.974 | 16 | 34 | 22.597 | | 26 | 10 | 24 | 15.600 | 0.939 | 13 | 33 | 30.761 |
| | 12 | 7 | 26 | 50.608 | -0.963 | 16 | 30 | 26.687 | | 27 | 10 | 28 | 12.155 | -0.942 | 13 | 29 | 34.851 |
| | 13 | 7 | 30 | 47.164 | 0.953 | 16 | 26 | 30.778 | | 28 | 10 | 32 | 08.711 | 0.948 | 13 | 25 | 38.942 |
| | 14 | 7 | 34 | 43.719 | 0.945 | 16 | 22 | 34.868 | Mar | 1 | 10 | 36 | 05.266 | 0.957 | 13 | 21 | 43.032 |
| | 15 | 7 | 38 | 40.274 | 0.941 | 16 | 18 | 38.959 | | 2 | 10 | 40 | 01.821 | 0.966 | 13 | 17 | 47.123 |
| | 16 | 7 | 42 | 36.830 | 0.940 | 16 | 14 | 43.049 | | 3 | 10 | 43 | 58.377 | 0.973 | 13 | 13 | 51.214 |
| | 17 | 7 | 46 | 33.385 | 0.942 | 16 | 10 | 47.140 | | 4 | 10 | 47 | 54.932 | 0.976 | 13 | 09 | 55.304 |
| | 18 | 7 | 50 | 29.940 | -0.946 | 16 | 06 | 51.230 | | 5 | 10 | 51 | 51.487 | -0.976 | 13 | 05 | 59.395 |
| | 19 | 7 | 54 | 26.496 | 0.951 | 16 | 02 | 55.321 | | 6 | 10 | 55 | 48.043 | 0.973 | 13 | 02 | 03.485 |
| | 20 | 7 | 58 | 23.051 | 0.955 | 15 | 58 | 59.411 | | 7 | 10 | 59 | 44.598 | 0.968 | 12 | 58 | 07.576 |
| | 21 | 8 | 02 | 19.607 | 0.958 | 15 | 55 | 03.502 | | 8 | 11 | 03 | 41.154 | 0.963 | 12 | 54 | 11.666 |
| | 22 | 8 | 06 | 16.162 | 0.960 | 15 | 51 | 07.592 | | 9 | 11 | 07 | 37.709 | 0.959 | 12 | 50 | 15.757 |
| | 23 | 8 | 10 | 12.717 | 0.959 | 15 | 47 | 11.683 | | 10 | 11 | 11 | 34.264 | 0.957 | 12 | 46 | 19.847 |
| | 24 | 8 | 14 | 09.273 | -0.956 | 15 | 43 | 15.773 | | 11 | 11 | 15 | 30.820 | -0.959 | 12 | 42 | 23.938 |
| | 25 | 8 | 18 | 05.828 | 0.951 | 15 | 39 | 19.864 | | 12 | 11 | 19 | 27.375 | 0.964 | 12 | 38 | 28.028 |
| | 26 | 8 | 22 | 02.383 | 0.944 | 15 | 35 | 23.954 | | 13 | 11 | 23 | 23.930 | 0.971 | 12 | 34 | 32.119 |
| | 27 | 8 | 25 | 58.939 | 0.937 | 15 | 31 | 28.045 | | 14 | 11 | 27 | 20.486 | 0.980 | 12 | 30 | 36.209 |
| | 28 | 8 | 29 | 55.494 | 0.931 | 15 | 27 | 32.135 | | 15 | 11 | 31 | 17.041 | 0.989 | 12 | 26 | 40.300 |
| | 29 | 8 | 33 | 52.050 | 0.926 | 15 | 23 | 36.226 | | 16 | 11 | 35 | 13.596 | 0.997 | 12 | 22 | 44.390 |
| | 30 | 8 | 37 | 48.605 | -0.925 | 15 | 19 | 40.317 | | 17 | 11 | 39 | 10.152 | -1.004 | 12 | 18 | 48.481 |
| | 31 | 8 | 41 | 45.160 | 0.927 | 15 | 15 | 44.407 | | 18 | 11 | 43 | 06.707 | 1.009 | 12 | 14 | 52.571 |
| Feb | 1 | 8 | 45 | 41.716 | 0.932 | 15 | 11 | 48.498 | | 19 | 11 | 47 | 03.263 | 1.011 | 12 | 10 | 56.662 |
| | 2 | 8 | 49 | 38.271 | 0.938 | 15 | 07 | 52.588 | | 20 | 11 | 50 | 59.818 | 1.012 | 12 | 07 | 00.753 |
| | 3 | 8 | 53 | 34.826 | 0.944 | 15 | 03 | 56.679 | | 21 | 11 | 54 | 56.373 | 1.010 | 12 | 03 | 04.843 |
| | 4 | 8 | 57 | 31.382 | 0.948 | 15 | 00 | 00.769 | | 22 | 11 | 58 | 52.929 | 1.007 | 11 | 59 | 08.934 |
| | 5 | 9 | 01 | 27.937 | -0.948 | 14 | 56 | 04.860 | | 23 | 12 | 02 | 49.484 | -1.004 | 11 | 55 | 13.024 |
| | 6 | 9 | 05 | 24.492 | 0.946 | 14 | 52 | 08.950 | | 24 | 12 | 06 | 46.039 | 1.002 | 11 | 51 | 17.115 |
| | 7 | 9 | 09 | 21.048 | 0.940 | 14 | 48 | 13.041 | | 25 | 12 | 10 | 42.595 | 1.001 | 11 | 47 | 21.205 |
| | 8 | 9 | 13 | 17.603 | 0.932 | 14 | 44 | 17.131 | | 26 | 12 | 14 | 39.150 | 1.004 | 11 | 43 | 25.296 |
| | 9 | 9 | 17 | 14.159 | 0.925 | 14 | 40 | 21.222 | | 27 | 12 | 18 | 35.706 | 1.010 | 11 | 39 | 29.386 |
| | 10 | 9 | 21 | 10.714 | 0.919 | 14 | 36 | 25.312 | | 28 | 12 | 22 | 32.261 | 1.018 | 11 | 35 | 33.477 |
| | 11 | 9 | 25 | 07.269 | -0.916 | 14 | 32 | 29.403 | | 29 | 12 | 26 | 28.816 | -1.027 | 11 | 31 | 37.567 |
| | 12 | 9 | 29 | 03.825 | 0.917 | 14 | 28 | 33.493 | | 30 | 12 | 30 | 25.372 | 1.036 | 11 | 27 | 41.658 |
| | 13 | 9 | 32 | 60.380 | 0.920 | 14 | 24 | 37.584 | | 31 | 12 | 34 | 21.927 | 1.041 | 11 | 23 | 45.748 |
| | 14 | 9 | 36 | 56.935 | 0.927 | 14 | 20 | 41.674 | Apr | 1 | 12 | 38 | 18.482 | 1.042 | 11 | 19 | 49.839 |
| | 15 | 9 | 40 | 53.491 | -0.934 | 14 | 16 | 45.765 | | 2 | 12 | 42 | 15.038 | -1.039 | 11 | 15 | 53.929 |

N.B.-Apparent Sidereal Time = Mean Sidereal Time + Equation of Equinoxes for the instant

## SIDEREAL TIME, 2021

| Date | | Mean Greenwich Sidereal Time at $0^h$ U.T. (G.H.A. of the Equinox) | Equation of the Equinox-es at $0^h$ U.T. | Greenwich Transit of Mean Equinox (U.T. at $0^h$ G.M.S.T.) | Date | | Mean Greenwich Sidereal Time at $0^h$ U.T. (G.H.A. of the Equinox) | Equation of the Equinox-es at $0^h$ U.T. | Greenwich Transit of Mean Equinox (U.T. at $0^h$ G.M.S.T.) |
|---|---|---|---|---|---|---|---|---|---|
| | | h m s | s | h m s | | | h m s | s | h m s |
| Apr | 1 | 12 38 18.482 | -1.042 | 11 19 49.839 | May | 17 | 15 39 40.029 | -1.053 | 8 18 58.003 |
| | 2 | 12 42 15.038 | 1.039 | 11 15 53.929 | | 18 | 15 43 36.585 | 1.048 | 8 15 02.094 |
| | 3 | 12 46 11.593 | 1.034 | 11 11 58.020 | | 19 | 15 47 33.140 | 1.045 | 8 11 06.184 |
| | 4 | 12 50 08.148 | 1.028 | 11 08 02.110 | | 20 | 15 51 29.695 | 1.045 | 8 07 10.275 |
| | 5 | 12 54 04.704 | 1.023 | 11 04 06.201 | | 21 | 15 55 26.251 | 1.048 | 8 03 14.365 |
| | 6 | 12 58 01.259 | 1.020 | 11 00 10.291 | | 22 | 15 59 22.806 | 1.053 | 7 59 18.456 |
| | 7 | 13 01 57.815 | -1.021 | 10 56 14.382 | | 23 | 16 03 19.362 | -1.058 | 7 55 22.546 |
| | 8 | 13 05 54.370 | 1.025 | 10 52 18.473 | | 24 | 16 07 15.917 | 1.062 | 7 51 26.637 |
| | 9 | 13 09 50.925 | 1.031 | 10 48 22.563 | | 25 | 16 11 12.472 | 1.063 | 7 47 30.727 |
| | 10 | 13 13 47.481 | 1.039 | 10 44 26.654 | | 26 | 16 15 09.028 | 1.059 | 7 43 34.818 |
| | 11 | 13 17 44.036 | 1.048 | 10 40 30.744 | | 27 | 16 19 05.583 | 1.051 | 7 39 38.908 |
| | 12 | 13 21 40.591 | 1.056 | 10 36 34.835 | | 28 | 16 23 02.138 | 1.040 | 7 35 42.999 |
| | 13 | 13 25 37.147 | -1.062 | 10 32 38.925 | | 29 | 16 26 58.694 | -1.028 | 7 31 47.090 |
| | 14 | 13 29 33.702 | 1.067 | 10 28 43.016 | | 30 | 16 30 55.249 | 1.018 | 7 27 51.180 |
| | 15 | 13 33 30.257 | 1.069 | 10 24 47.106 | | 31 | 16 34 51.804 | 1.012 | 7 23 55.271 |
| | 16 | 13 37 26.813 | 1.069 | 10 20 51.197 | Jun | 1 | 16 38 48.360 | 1.009 | 7 19 59.361 |
| | 17 | 13 41 23.368 | 1.067 | 10 16 55.287 | | 2 | 16 42 44.915 | 1.010 | 7 16 03.452 |
| | 18 | 13 45 19.924 | 1.063 | 10 12 59.378 | | 3 | 16 46 41.471 | 1.013 | 7 12 07.542 |
| | 19 | 13 49 16.479 | -1.059 | 10 09 03.468 | | 4 | 16 50 38.026 | -1.017 | 7 08 11.633 |
| | 20 | 13 53 13.034 | 1.055 | 10 05 07.559 | | 5 | 16 54 34.581 | 1.022 | 7 04 15.723 |
| | 21 | 13 57 09.590 | 1.053 | 10 01 11.649 | | 6 | 16 58 31.137 | 1.025 | 7 00 19.814 |
| | 22 | 14 01 06.145 | 1.053 | 9 57 15.740 | | 7 | 17 02 27.692 | 1.027 | 6 56 23.904 |
| | 23 | 14 05 02.700 | 1.056 | 9 53 19.831 | | 8 | 17 06 24.247 | 1.026 | 6 52 27.995 |
| | 24 | 14 08 59.256 | 1.062 | 9 49 23.921 | | 9 | 17 10 20.803 | 1.023 | 6 48 32.085 |
| | 25 | 14 12 55.811 | -1.069 | 9 45 28.012 | | 10 | 17 14 17.358 | -1.017 | 6 44 36.176 |
| | 26 | 14 16 52.367 | 1.077 | 9 41 32.102 | | 11 | 17 18 13.914 | 1.010 | 6 40 40.266 |
| | 27 | 14 20 48.922 | 1.082 | 9 37 36.193 | | 12 | 17 22 10.469 | 1.003 | 6 36 44.357 |
| | 28 | 14 24 45.477 | 1.083 | 9 33 40.283 | | 13 | 17 26 07.024 | 0.995 | 6 32 48.448 |
| | 29 | 14 28 42.033 | 1.079 | 9 29 44.374 | | 14 | 17 30 03.580 | 0.988 | 6 28 52.538 |
| | 30 | 14 32 38.588 | 1.072 | 9 25 48.464 | | 15 | 17 33 60.135 | 0.984 | 6 24 56.629 |
| May | 1 | 14 36 35.143 | -1.063 | 9 21 52.555 | | 16 | 17 37 56.690 | -0.982 | 6 21 00.719 |
| | 2 | 14 40 31.699 | 1.055 | 9 17 56.645 | | 17 | 17 41 53.246 | 0.983 | 6 17 04.810 |
| | 3 | 14 44 28.254 | 1.049 | 9 14 00.736 | | 18 | 17 45 49.801 | 0.986 | 6 13 08.900 |
| | 4 | 14 48 24.810 | 1.047 | 9 10 04.826 | | 19 | 17 49 46.356 | 0.990 | 6 09 12.991 |
| | 5 | 14 52 21.365 | 1.047 | 9 06 08.917 | | 20 | 17 53 42.912 | 0.993 | 6 05 17.081 |
| | 6 | 14 56 17.920 | 1.051 | 9 02 13.007 | | 21 | 17 57 39.467 | 0.995 | 6 01 21.172 |
| | 7 | 15 00 14.476 | -1.056 | 8 58 17.098 | | 22 | 18 01 36.023 | -0.992 | 5 57 25.262 |
| | 8 | 15 04 11.031 | 1.063 | 8 54 21.188 | | 23 | 18 05 32.578 | 0.985 | 5 53 29.353 |
| | 9 | 15 08 07.586 | 1.069 | 8 50 25.279 | | 24 | 18 09 29.133 | 0.974 | 5 49 33.443 |
| | 10 | 15 12 04.142 | 1.074 | 8 46 29.370 | | 25 | 18 13 25.689 | 0.962 | 5 45 37.534 |
| | 11 | 15 15 60.697 | 1.076 | 8 42 33.460 | | 26 | 18 17 22.244 | 0.950 | 5 41 41.624 |
| | 12 | 15 19 57.252 | 1.077 | 8 38 37.551 | | 27 | 18 21 18.799 | 0.942 | 5 37 45.715 |
| | 13 | 15 23 53.808 | -1.075 | 8 34 41.641 | | 28 | 18 25 15.355 | -0.937 | 5 33 49.806 |
| | 14 | 15 27 50.363 | 1.071 | 8 30 45.732 | | 29 | 18 29 11.910 | 0.936 | 5 29 53.896 |
| | 15 | 15 31 46.919 | 1.065 | 8 26 49.822 | | 30 | 18 33 08.466 | 0.937 | 5 25 57.987 |
| | 16 | 15 35 43.474 | 1.059 | 8 22 53.913 | Jul | 1 | 18 37 05.021 | 0.941 | 5 22 02.077 |
| | 17 | 15 39 40.029 | -1.053 | 8 18 58.003 | | 2 | 18 41 01.576 | -0.945 | 5 18 06.168 |

N.B.-Apparent Sidereal Time = Mean Sidereal Time + Equation of Equinoxes for the instant

## SIDEREAL TIME, 2021

| Date | | Mean Greenwich Sidereal Time at $0^h$ U.T. (G.H.A. of the Equinox) | | | Equation of the Equinox-es at $0^h$ U.T. | Greenwich Transit of Mean Equinox (U.T. at $0^h$ G.M.S.T.) | | | Date | | Mean Greenwich Sidereal Time at $0^h$ U.T. (G.H.A. of the Equinox) | | | Equation of the Equinox-es at $0^h$ U.T. | Greenwich Transit of Mean Equinox (U.T. at $0^h$ G.M.S.T.) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | s | h | m | s | | | h | m | s | s | h | m | s |
| Jul | 1 | 18 | 37 | 05.021 | -0.941 | 5 | 22 | 02.077 | Aug | 16 | 21 | 38 | 26.568 | -0.905 | 2 | 21 | 10.241 |
| | 2 | 18 | 41 | 01.576 | 0.945 | 5 | 18 | 06.168 | | 17 | 21 | 42 | 23.123 | 0.900 | 2 | 17 | 14.332 |
| | 3 | 18 | 44 | 58.132 | 0.949 | 5 | 14 | 10.258 | | 18 | 21 | 46 | 19.679 | 0.893 | 2 | 13 | 18.423 |
| | 4 | 18 | 48 | 54.687 | 0.951 | 5 | 10 | 14.349 | | 19 | 21 | 50 | 16.234 | 0.885 | 2 | 09 | 22.513 |
| | 5 | 18 | 52 | 51.242 | 0.951 | 5 | 06 | 18.439 | | 20 | 21 | 54 | 12.789 | 0.879 | 2 | 05 | 26.604 |
| | 6 | 18 | 56 | 47.798 | 0.948 | 5 | 02 | 22.530 | | 21 | 21 | 58 | 09.345 | 0.875 | 2 | 01 | 30.694 |
| | 7 | 19 | 00 | 44.353 | -0.944 | 4 | 58 | 26.620 | | 22 | 22 | 02 | 05.900 | -0.874 | 1 | 57 | 34.785 |
| | 8 | 19 | 04 | 40.908 | 0.937 | 4 | 54 | 30.711 | | 23 | 22 | 06 | 02.455 | 0.878 | 1 | 53 | 38.875 |
| | 9 | 19 | 08 | 37.464 | 0.930 | 4 | 50 | 34.801 | | 24 | 22 | 09 | 59.011 | 0.884 | 1 | 49 | 42.966 |
| | 10 | 19 | 12 | 34.019 | 0.922 | 4 | 46 | 38.892 | | 25 | 22 | 13 | 55.566 | 0.892 | 1 | 45 | 47.056 |
| | 11 | 19 | 16 | 30.575 | 0.916 | 4 | 42 | 42.982 | | 26 | 22 | 17 | 52.122 | 0.900 | 1 | 41 | 51.147 |
| | 12 | 19 | 20 | 27.130 | 0.911 | 4 | 38 | 47.073 | | 27 | 22 | 21 | 48.677 | 0.907 | 1 | 37 | 55.237 |
| | 13 | 19 | 24 | 23.685 | -0.909 | 4 | 34 | 51.163 | | 28 | 22 | 25 | 45.232 | -0.912 | 1 | 33 | 59.328 |
| | 14 | 19 | 28 | 20.241 | 0.910 | 4 | 30 | 55.254 | | 29 | 22 | 29 | 41.788 | 0.915 | 1 | 30 | 03.418 |
| | 15 | 19 | 32 | 16.796 | 0.913 | 4 | 26 | 59.345 | | 30 | 22 | 33 | 38.343 | 0.916 | 1 | 26 | 07.509 |
| | 16 | 19 | 36 | 13.351 | 0.918 | 4 | 23 | 03.435 | | 31 | 22 | 37 | 34.898 | 0.915 | 1 | 22 | 11.599 |
| | 17 | 19 | 40 | 09.907 | 0.923 | 4 | 19 | 07.526 | Sep | 1 | 22 | 41 | 31.454 | 0.912 | 1 | 18 | 15.690 |
| | 18 | 19 | 44 | 06.462 | 0.926 | 4 | 15 | 11.616 | | 2 | 22 | 45 | 28.009 | 0.908 | 1 | 14 | 19.780 |
| | 19 | 19 | 48 | 03.018 | -0.926 | 4 | 11 | 15.707 | | 3 | 22 | 49 | 24.564 | -0.905 | 1 | 10 | 23.871 |
| | 20 | 19 | 51 | 59.573 | 0.922 | 4 | 07 | 19.797 | | 4 | 22 | 53 | 21.120 | 0.903 | 1 | 06 | 27.962 |
| | 21 | 19 | 55 | 56.128 | 0.914 | 4 | 03 | 23.888 | | 5 | 22 | 57 | 17.675 | 0.903 | 1 | 02 | 32.052 |
| | 22 | 19 | 59 | 52.684 | 0.903 | 3 | 59 | 27.978 | | 6 | 23 | 01 | 14.231 | 0.906 | 0 | 58 | 36.143 |
| | 23 | 20 | 03 | 49.239 | 0.893 | 3 | 55 | 32.069 | | 7 | 23 | 05 | 10.786 | 0.912 | 0 | 54 | 40.233 |
| | 24 | 20 | 07 | 45.794 | 0.884 | 3 | 51 | 36.159 | | 8 | 23 | 09 | 07.341 | 0.920 | 0 | 50 | 44.324 |
| | 25 | 20 | 11 | 42.350 | -0.879 | 3 | 47 | 40.250 | | 9 | 23 | 13 | 03.897 | -0.929 | 0 | 46 | 48.414 |
| | 26 | 20 | 15 | 38.905 | 0.878 | 3 | 43 | 44.340 | | 10 | 23 | 16 | 60.452 | 0.937 | 0 | 42 | 52.505 |
| | 27 | 20 | 19 | 35.460 | 0.880 | 3 | 39 | 48.431 | | 11 | 23 | 20 | 57.007 | 0.943 | 0 | 38 | 56.595 |
| | 28 | 20 | 23 | 32.016 | 0.885 | 3 | 35 | 52.521 | | 12 | 23 | 24 | 53.563 | 0.944 | 0 | 35 | 00.686 |
| | 29 | 20 | 27 | 28.571 | 0.891 | 3 | 31 | 56.612 | | 13 | 23 | 28 | 50.118 | 0.942 | 0 | 31 | 04.776 |
| | 30 | 20 | 31 | 25.127 | 0.896 | 3 | 28 | 00.702 | | 14 | 23 | 32 | 46.674 | 0.937 | 0 | 27 | 08.867 |
| | 31 | 20 | 35 | 21.682 | -0.901 | 3 | 24 | 04.793 | | 15 | 23 | 36 | 43.229 | -0.931 | 0 | 23 | 12.957 |
| Aug | 1 | 20 | 39 | 18.237 | 0.903 | 3 | 20 | 08.883 | | 16 | 23 | 40 | 39.784 | 0.926 | 0 | 19 | 17.048 |
| | 2 | 20 | 43 | 14.793 | 0.903 | 3 | 16 | 12.974 | | 17 | 23 | 44 | 36.340 | 0.923 | 0 | 15 | 21.138 |
| | 3 | 20 | 47 | 11.348 | 0.901 | 3 | 12 | 17.065 | | 18 | 23 | 48 | 32.895 | 0.923 | 0 | 11 | 25.229 |
| | 4 | 20 | 51 | 07.903 | 0.897 | 3 | 08 | 21.155 | | 19 | 23 | 52 | 29.450 | 0.927 | 0 | 07 | 29.320 |
| | 5 | 20 | 55 | 04.459 | 0.891 | 3 | 04 | 25.246 | | 20 | 23 | 56 | 26.006 | 0.934 | 0 | 03 | 33.410 |
| | 6 | 20 | 59 | 01.014 | -0.885 | 3 | 00 | 29.336 | | 21 | 0 | 00 | 22.561 | -0.942 | 23 | 55 | 41.591 |
| | 7 | 21 | 02 | 57.570 | 0.880 | 2 | 56 | 33.427 | | 22 | 0 | 04 | 19.116 | 0.952 | 23 | 51 | 45.682 |
| | 8 | 21 | 06 | 54.125 | 0.877 | 2 | 52 | 37.517 | | 23 | 0 | 08 | 15.672 | 0.960 | 23 | 47 | 49.772 |
| | 9 | 21 | 10 | 50.680 | 0.876 | 2 | 48 | 41.608 | | 24 | 0 | 12 | 12.227 | 0.967 | 23 | 43 | 53.863 |
| | 10 | 21 | 14 | 47.236 | 0.878 | 2 | 44 | 45.698 | | 25 | 0 | 16 | 08.783 | 0.972 | 23 | 39 | 57.953 |
| | 11 | 21 | 18 | 43.791 | 0.883 | 2 | 40 | 49.789 | | 26 | 0 | 20 | 05.338 | 0.974 | 23 | 36 | 02.044 |
| | 12 | 21 | 22 | 40.346 | -0.890 | 2 | 36 | 53.879 | | 27 | 0 | 24 | 01.893 | -0.974 | 23 | 32 | 06.134 |
| | 13 | 21 | 26 | 36.902 | 0.897 | 2 | 32 | 57.970 | | 28 | 0 | 27 | 58.449 | 0.972 | 23 | 28 | 10.225 |
| | 14 | 21 | 30 | 33.457 | 0.903 | 2 | 29 | 02.060 | | 29 | 0 | 31 | 55.004 | 0.969 | 23 | 24 | 14.315 |
| | 15 | 21 | 34 | 30.012 | 0.906 | 2 | 25 | 06.151 | | 30 | 0 | 35 | 51.559 | 0.966 | 23 | 20 | 18.406 |
| | 16 | 21 | 38 | 26.568 | -0.905 | 2 | 21 | 10.241 | Oct | 1 | 0 | 39 | 48.115 | -0.964 | 23 | 16 | 22.496 |

N.B.-Apparent Sidereal Time = Mean Sidereal Time + Equation of Equinoxes for the instant

## SIDEREAL TIME, 2021

| Date | | Mean Greenwich Sidereal Time at $0^h$ U.T. (G.H.A. of the Equinox) | | | Equation of the Equinox-es at $0^h$ U.T. | Greenwich Transit of Mean Equinox (U.T. at $0^h$ G.M.S.T.) | | | Date | | Mean Greenwich Sidereal Time at $0^h$ U.T. (G.H.A. of the Equinox) | | | Equation of the Equinox-es at $0^h$ U.T. | Greenwich Transit of Mean Equinox (U.T. at $0^h$ G.M.S.T.) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | s | h | m | s | | | h | m | s | s | h | m | s |
| Oct | 1 | 0 | 39 | 48.115 | -0.964 | 23 | 16 | 22.496 | Nov | 16 | 3 | 41 | 09.662 | -1.005 | 20 | 15 | 30.661 |
| | 2 | 0 | 43 | 44.670 | 0.964 | 23 | 12 | 26.587 | | 17 | 3 | 45 | 06.217 | 1.009 | 20 | 11 | 34.751 |
| | 3 | 0 | 47 | 41.226 | 0.966 | 23 | 08 | 30.678 | | 18 | 3 | 49 | 02.772 | 1.011 | 20 | 07 | 38.842 |
| | 4 | 0 | 51 | 37.781 | 0.971 | 23 | 04 | 34.768 | | 19 | 3 | 52 | 59.328 | 1.010 | 20 | 03 | 42.932 |
| | 5 | 0 | 55 | 34.336 | 0.979 | 23 | 00 | 38.859 | | 20 | 3 | 56 | 55.883 | 1.008 | 19 | 59 | 47.023 |
| | 6 | 0 | 59 | 30.892 | 0.988 | 22 | 56 | 42.949 | | 21 | 4 | 00 | 52.439 | 1.003 | 19 | 55 | 51.113 |
| | 7 | 1 | 03 | 27.447 | -0.997 | 22 | 52 | 47.040 | | 22 | 4 | 04 | 48.994 | -0.996 | 19 | 51 | 55.204 |
| | 8 | 1 | 07 | 24.002 | 1.003 | 22 | 48 | 51.130 | | 23 | 4 | 08 | 45.549 | 0.989 | 19 | 47 | 59.295 |
| | 9 | 1 | 11 | 20.558 | 1.005 | 22 | 44 | 55.221 | | 24 | 4 | 12 | 42.105 | 0.982 | 19 | 44 | 03.385 |
| | 10 | 1 | 15 | 17.113 | 1.004 | 22 | 40 | 59.311 | | 25 | 4 | 16 | 38.660 | 0.977 | 19 | 40 | 07.476 |
| | 11 | 1 | 19 | 13.668 | 0.998 | 22 | 37 | 03.402 | | 26 | 4 | 20 | 35.215 | 0.973 | 19 | 36 | 11.566 |
| | 12 | 1 | 23 | 10.224 | 0.991 | 22 | 33 | 07.492 | | 27 | 4 | 24 | 31.771 | 0.972 | 19 | 32 | 15.657 |
| | 13 | 1 | 27 | 06.779 | -0.985 | 22 | 29 | 11.583 | | 28 | 4 | 28 | 28.326 | -0.974 | 19 | 28 | 19.747 |
| | 14 | 1 | 31 | 03.335 | 0.980 | 22 | 25 | 15.673 | | 29 | 4 | 32 | 24.882 | 0.977 | 19 | 24 | 23.838 |
| | 15 | 1 | 34 | 59.890 | 0.979 | 22 | 21 | 19.764 | | 30 | 4 | 36 | 21.437 | 0.982 | 19 | 20 | 27.928 |
| | 16 | 1 | 38 | 56.445 | 0.981 | 22 | 17 | 23.854 | Dec | 1 | 4 | 40 | 17.992 | 0.985 | 19 | 16 | 32.019 |
| | 17 | 1 | 42 | 53.001 | 0.987 | 22 | 13 | 27.945 | | 2 | 4 | 44 | 14.548 | 0.987 | 19 | 12 | 36.109 |
| | 18 | 1 | 46 | 49.556 | 0.994 | 22 | 09 | 32.036 | | 3 | 4 | 48 | 11.103 | 0.984 | 19 | 08 | 40.200 |
| | 19 | 1 | 50 | 46.111 | -1.002 | 22 | 05 | 36.126 | | 4 | 4 | 52 | 07.658 | -0.976 | 19 | 04 | 44.290 |
| | 20 | 1 | 54 | 42.667 | 1.010 | 22 | 01 | 40.217 | | 5 | 4 | 56 | 04.214 | 0.964 | 19 | 00 | 48.381 |
| | 21 | 1 | 58 | 39.222 | 1.017 | 21 | 57 | 44.307 | | 6 | 4 | 59 | 60.769 | 0.951 | 18 | 56 | 52.471 |
| | 22 | 2 | 02 | 35.778 | 1.021 | 21 | 53 | 48.398 | | 7 | 5 | 03 | 57.324 | 0.939 | 18 | 52 | 56.562 |
| | 23 | 2 | 06 | 32.333 | 1.022 | 21 | 49 | 52.488 | | 8 | 5 | 07 | 53.880 | 0.929 | 18 | 49 | 00.653 |
| | 24 | 2 | 10 | 28.888 | 1.021 | 21 | 45 | 56.579 | | 9 | 5 | 11 | 50.435 | 0.924 | 18 | 45 | 04.743 |
| | 25 | 2 | 14 | 25.444 | -1.019 | 21 | 42 | 00.669 | | 10 | 5 | 15 | 46.991 | -0.923 | 18 | 41 | 08.834 |
| | 26 | 2 | 18 | 21.999 | 1.014 | 21 | 38 | 04.760 | | 11 | 5 | 19 | 43.546 | 0.925 | 18 | 37 | 12.924 |
| | 27 | 2 | 22 | 18.554 | 1.010 | 21 | 34 | 08.850 | | 12 | 5 | 23 | 40.101 | 0.928 | 18 | 33 | 17.015 |
| | 28 | 2 | 26 | 15.110 | 1.006 | 21 | 30 | 12.941 | | 13 | 5 | 27 | 36.657 | 0.932 | 18 | 29 | 21.105 |
| | 29 | 2 | 30 | 11.665 | 1.004 | 21 | 26 | 17.031 | | 14 | 5 | 31 | 33.212 | 0.935 | 18 | 25 | 25.196 |
| | 30 | 2 | 34 | 08.220 | 1.003 | 21 | 22 | 21.122 | | 15 | 5 | 35 | 29.767 | 0.935 | 18 | 21 | 29.286 |
| | 31 | 2 | 38 | 04.776 | -1.005 | 21 | 18 | 25.212 | | 16 | 5 | 39 | 26.323 | -0.934 | 18 | 17 | 33.377 |
| Nov | 1 | 2 | 42 | 01.331 | 1.010 | 21 | 14 | 29.303 | | 17 | 5 | 43 | 22.878 | 0.930 | 18 | 13 | 37.467 |
| | 2 | 2 | 45 | 57.887 | 1.017 | 21 | 10 | 33.394 | | 18 | 5 | 47 | 19.434 | 0.924 | 18 | 09 | 41.558 |
| | 3 | 2 | 49 | 54.442 | 1.024 | 21 | 06 | 37.484 | | 19 | 5 | 51 | 15.989 | 0.916 | 18 | 05 | 45.648 |
| | 4 | 2 | 53 | 50.997 | 1.029 | 21 | 02 | 41.575 | | 20 | 5 | 55 | 12.544 | 0.908 | 18 | 01 | 49.739 |
| | 5 | 2 | 57 | 47.553 | 1.031 | 20 | 58 | 45.665 | | 21 | 5 | 59 | 09.100 | 0.900 | 17 | 57 | 53.829 |
| | 6 | 3 | 01 | 44.108 | -1.028 | 20 | 54 | 49.756 | | 22 | 6 | 03 | 05.655 | -0.892 | 17 | 53 | 57.920 |
| | 7 | 3 | 05 | 40.663 | 1.021 | 20 | 50 | 53.846 | | 23 | 6 | 07 | 02.210 | 0.887 | 17 | 50 | 02.011 |
| | 8 | 3 | 09 | 37.219 | 1.011 | 20 | 46 | 57.937 | | 24 | 6 | 10 | 58.766 | 0.884 | 17 | 46 | 06.101 |
| | 9 | 3 | 13 | 33.774 | 1.001 | 20 | 43 | 02.027 | | 25 | 6 | 14 | 55.321 | 0.884 | 17 | 42 | 10.192 |
| | 10 | 3 | 17 | 30.330 | 0.993 | 20 | 39 | 06.118 | | 26 | 6 | 18 | 51.876 | 0.886 | 17 | 38 | 14.282 |
| | 11 | 3 | 21 | 26.885 | 0.988 | 20 | 35 | 10.208 | | 27 | 6 | 22 | 48.432 | 0.890 | 17 | 34 | 18.373 |
| | 12 | 3 | 25 | 23.440 | -0.987 | 20 | 31 | 14.299 | | 28 | 6 | 26 | 44.987 | -0.893 | 17 | 30 | 22.463 |
| | 13 | 3 | 29 | 19.996 | 0.989 | 20 | 27 | 18.389 | | 29 | 6 | 30 | 41.543 | 0.895 | 17 | 26 | 26.554 |
| | 14 | 3 | 33 | 16.551 | 0.994 | 20 | 23 | 22.480 | | 30 | 6 | 34 | 38.098 | 0.893 | 17 | 22 | 30.644 |
| | 15 | 3 | 37 | 13.106 | 0.999 | 20 | 19 | 26.570 | | 31 | 6 | 38 | 34.653 | 0.887 | 17 | 18 | 34.735 |
| | 16 | 3 | 41 | 09.662 | -1.005 | 20 | 15 | 30.661 | | 32 | 6 | 42 | 31.209 | -0.877 | 17 | 14 | 38.825 |

N.B.-Apparent Sidereal Time = Mean Sidereal Time + Equation of Equinoxes for the instant

## SUN, 2021
## MEAN LONGITUDE AND ANOMALY

| Date | | Horizontal Parallax | Mean Longitude | | | Mean Anomaly | Date | | Horizontal Parallax | Mean Longitude | | | Mean Anomaly |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | " | ° | ′ | " | ° | | | " | ° | ′ | " | ° |
| Jan. | 1 | 8.94 | 280 | 52 | 28.280 | 357.576 | July | 10 | 8.65 | 108 | 08 | 51.074 | 184.840 |
| | 11 | 8.94 | 290 | 43 | 51.585 | 7.432 | | 20 | 8.65 | 118 | 00 | 14.379 | 194.696 |
| | 21 | 8.94 | 300 | 35 | 14.890 | 17.288 | | 30 | 8.66 | 127 | 51 | 37.684 | 204.552 |
| | 31 | 8.93 | 310 | 26 | 38.195 | 27.144 | Aug. | 9 | 8.67 | 137 | 43 | 00.989 | 214.408 |
| Feb. | 10 | 8.91 | 320 | 18 | 01.499 | 37.000 | | 19 | 8.69 | 147 | 34 | 24.294 | 224.264 |
| | 20 | 8.89 | 330 | 09 | 24.804 | 46.856 | | 29 | 8.71 | 157 | 25 | 47.599 | 234.120 |
| Mar. | 2 | 8.87 | 340 | 00 | 48.109 | 56.712 | Sept. | 8 | 8.73 | 167 | 17 | 10.904 | 243.976 |
| | 12 | 8.85 | 349 | 52 | 11.414 | 66.568 | | 18 | 8.75 | 177 | 08 | 34.209 | 253.832 |
| | 22 | 8.83 | 359 | 43 | 34.719 | 76.424 | | 28 | 8.78 | 186 | 59 | 57.514 | 263.688 |
| Apr. | 1 | 8.80 | 9 | 34 | 58.024 | 86.280 | Oct. | 8 | 8.80 | 196 | 51 | 20.819 | 273.544 |
| | 11 | 8.78 | 19 | 26 | 21.329 | 96.136 | | 18 | 8.83 | 206 | 42 | 44.123 | 283.400 |
| | 21 | 8.75 | 29 | 17 | 44.634 | 105.992 | | 28 | 8.85 | 216 | 34 | 07.428 | 293.256 |
| May | 1 | 8.73 | 39 | 09 | 07.939 | 115.848 | Nov. | 7 | 8.87 | 226 | 25 | 30.733 | 303.112 |
| | 11 | 8.71 | 49 | 00 | 31.244 | 125.704 | | 17 | 8.89 | 236 | 16 | 54.038 | 312.968 |
| | 21 | 8.69 | 58 | 51 | 54.549 | 135.560 | | 27 | 8.91 | 246 | 08 | 17.343 | 322.824 |
| | 31 | 8.67 | 68 | 43 | 17.854 | 145.416 | Dec. | 7 | 8.93 | 255 | 59 | 40.648 | 332.680 |
| June | 10 | 8.66 | 78 | 34 | 41.159 | 155.272 | | 17 | 8.94 | 265 | 51 | 03.953 | 342.536 |
| | 20 | 8.65 | 88 | 26 | 04.464 | 165.128 | | 27 | 8.94 | 275 | 42 | 27.258 | 352.392 |
| | 30 | 8.65 | 98 | 17 | 27.769 | 174.984 | | 37 | 8.94 | 285 | 33 | 50.563 | 2.248 |
| July | 10 | 8.65 | 108 | 08 | 51.074 | 184.840 | | 47 | 8.94 | 295 | 25 | 13.868 | 12.104 |

**SUN, 2021**

FOR $0^h$ TERRESTRIAL TIME

| Date | | Geometric Longitude* (Mean Equinox of date) ° | ' | " | Latitude (Ecliptic of date) " | Apparent Longitude (True equinox of date) ° | ' | " | Aberration " | Prec. in Long. (J 2021.5 of date) " | Nut. in Long. " | Nut. in Obliquity " | True Obliquity (23° 26') " |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan | 0 | 279 | 46 | 13.15 | +0.18 | 279 | 45 | 36.07 | 20.84 | -25.48 | -16.28 | +1.22 | 12.79 |
| | 1 | 280 | 47 | 21.21 | 0.29 | 280 | 46 | 44.26 | 20.84 | 25.34 | 16.16 | 1.26 | 12.83 |
| | 2 | 281 | 48 | 29.49 | 0.40 | 281 | 47 | 52.62 | 20.84 | 25.20 | 16.07 | 1.32 | 12.89 |
| | 3 | 282 | 49 | 37.96 | 0.43 | 282 | 49 | 01.13 | 20.84 | 25.07 | 16.03 | 1.39 | 12.96 |
| | 4 | 283 | 50 | 46.66 | 0.47 | 283 | 50 | 09.82 | 20.84 | 24.93 | 16.04 | 1.45 | 13.02 |
| | 5 | 284 | 51 | 55.65 | 0.47 | 284 | 51 | 18.76 | 20.84 | 24.79 | 16.09 | 1.50 | 13.06 |
| | 6 | 285 | 53 | 04.83 | +0.43 | 285 | 52 | 27.88 | 20.84 | -24.65 | -16.16 | +1.52 | 13.08 |
| | 7 | 286 | 54 | 14.22 | 0.40 | 286 | 53 | 37.21 | 20.84 | 24.51 | 16.21 | 1.52 | 13.08 |
| | 8 | 287 | 55 | 23.82 | 0.29 | 287 | 54 | 46.80 | 20.84 | 24.37 | 16.23 | 1.50 | 13.06 |
| | 9 | 288 | 56 | 33.55 | 0.18 | 288 | 55 | 56.57 | 20.84 | 24.23 | 16.18 | 1.47 | 13.03 |
| | 10 | 289 | 57 | 43.36 | +0.04 | 289 | 57 | 06.48 | 20.84 | 24.09 | 16.08 | 1.44 | 13.00 |
| | 11 | 290 | 58 | 53.11 | -0.11 | 290 | 58 | 16.39 | 20.84 | 23.95 | 15.93 | 1.43 | 12.98 |
| | 12 | 292 | 00 | 02.74 | -0.22 | 291 | 59 | 26.20 | 20.84 | -23.82 | -15.75 | +1.44 | 12.99 |
| | 13 | 293 | 01 | 12.13 | 0.36 | 293 | 00 | 35.75 | 20.84 | 23.68 | 15.59 | 1.48 | 13.03 |
| | 14 | 294 | 02 | 21.19 | 0.47 | 294 | 01 | 44.94 | 20.84 | 23.54 | 15.46 | 1.53 | 13.09 |
| | 15 | 295 | 03 | 29.77 | 0.54 | 295 | 02 | 53.59 | 20.84 | 23.40 | 15.38 | 1.61 | 13.16 |
| | 16 | 296 | 04 | 37.79 | 0.61 | 296 | 04 | 01.63 | 20.84 | 23.26 | 15.37 | 1.68 | 13.23 |
| | 17 | 297 | 05 | 45.18 | 0.65 | 297 | 05 | 08.99 | 20.83 | 23.12 | 15.40 | 1.74 | 13.29 |
| | 18 | 298 | 06 | 51.84 | -0.65 | 298 | 06 | 15.59 | 20.83 | -22.98 | -15.47 | +1.79 | 13.34 |
| | 19 | 299 | 07 | 57.76 | 0.61 | 299 | 07 | 21.43 | 20.83 | 22.84 | 15.54 | 1.82 | 13.36 |
| | 20 | 300 | 09 | 02.78 | 0.54 | 300 | 08 | 26.38 | 20.83 | 22.70 | 15.62 | 1.83 | 13.37 |
| | 21 | 301 | 10 | 06.94 | 0.47 | 301 | 09 | 30.49 | 20.83 | 22.57 | 15.67 | 1.83 | 13.37 |
| | 22 | 302 | 11 | 10.18 | 0.36 | 302 | 10 | 33.71 | 20.83 | 22.43 | 15.69 | 1.82 | 13.36 |
| | 23 | 303 | 12 | 12.48 | 0.25 | 303 | 11 | 36.02 | 20.82 | 22.29 | 15.68 | 1.80 | 13.34 |
| | 24 | 304 | 13 | 13.77 | -0.11 | 304 | 12 | 37.37 | 20.82 | -22.15 | -15.63 | +1.79 | 13.33 |
| | 25 | 305 | 14 | 14.09 | 0.00 | 305 | 13 | 37.78 | 20.82 | 22.01 | 15.54 | 1.79 | 13.33 |
| | 26 | 306 | 15 | 13.42 | +0.14 | 306 | 14 | 37.21 | 20.82 | 21.87 | 15.44 | 1.80 | 13.34 |
| | 27 | 307 | 16 | 11.76 | 0.29 | 307 | 15 | 35.68 | 20.82 | 21.73 | 15.32 | 1.83 | 13.37 |
| | 28 | 308 | 17 | 09.11 | 0.40 | 308 | 16 | 33.13 | 20.81 | 21.59 | 15.21 | 1.89 | 13.42 |
| | 29 | 309 | 18 | 05.49 | 0.47 | 309 | 17 | 29.58 | 20.81 | 21.45 | 15.14 | 1.96 | 13.49 |
| | 30 | 310 | 19 | 00.97 | +0.54 | 310 | 18 | 25.09 | 20.81 | -21.31 | -15.12 | +2.03 | 13.57 |
| | 31 | 311 | 19 | 55.54 | 0.58 | 311 | 19 | 19.63 | 20.80 | 21.18 | 15.15 | 2.11 | 13.64 |
| Feb | 1 | 312 | 20 | 49.26 | 0.61 | 312 | 20 | 13.27 | 20.80 | 21.04 | 15.23 | 2.17 | 13.70 |
| | 2 | 313 | 21 | 42.13 | 0.58 | 313 | 21 | 06.05 | 20.80 | 20.90 | 15.33 | 2.21 | 13.74 |
| | 3 | 314 | 22 | 34.21 | 0.50 | 314 | 21 | 58.03 | 20.80 | 20.76 | 15.43 | 2.22 | 13.75 |
| | 4 | 315 | 23 | 25.50 | 0.43 | 315 | 22 | 49.26 | 20.79 | 20.62 | 15.50 | 2.21 | 13.74 |
| | 5 | 316 | 24 | 15.95 | +0.32 | 316 | 23 | 39.70 | 20.79 | -20.48 | -15.51 | +2.19 | 13.72 |
| | 6 | 317 | 25 | 05.54 | 0.22 | 317 | 24 | 29.34 | 20.78 | 20.34 | 15.46 | 2.17 | 13.69 |
| | 7 | 318 | 25 | 54.26 | +0.07 | 318 | 25 | 18.16 | 20.78 | 20.20 | 15.37 | 2.16 | 13.68 |
| | 8 | 319 | 26 | 42.01 | -0.07 | 319 | 26 | 06.04 | 20.78 | 20.06 | 15.25 | 2.17 | 13.69 |
| | 9 | 320 | 27 | 28.76 | 0.18 | 320 | 26 | 52.91 | 20.77 | 19.93 | 15.12 | 2.20 | 13.72 |
| | 10 | 321 | 28 | 14.38 | 0.29 | 321 | 27 | 38.63 | 20.77 | 19.79 | 15.03 | 2.26 | 13.78 |
| | 11 | 322 | 28 | 58.83 | -0.36 | 322 | 28 | 23.12 | 20.77 | -19.65 | -14.98 | +2.33 | 13.85 |
| | 12 | 323 | 29 | 41.96 | 0.43 | 323 | 29 | 06.25 | 20.76 | 19.51 | 14.99 | 2.41 | 13.92 |
| | 13 | 324 | 30 | 23.70 | 0.47 | 324 | 29 | 47.94 | 20.76 | 19.37 | 15.05 | 2.48 | 13.99 |
| | 14 | 325 | 31 | 04.01 | 0.47 | 325 | 30 | 28.15 | 20.75 | 19.23 | 15.15 | 2.53 | 14.05 |
| | 15 | 326 | 31 | 42.72 | -0.47 | 326 | 31 | 06.74 | 20.75 | -19.09 | -15.27 | +2.57 | 14.08 |

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -18' 01".251 and subtract precession from J 2021.5.

**SUN, 2021**

FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Semi Diameter | | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | ' | " | h | m | s |
| Jan | 0 | 18 | 42 | 28.43 | -23 | 04 | 40.18 | 0.983 2780 | 16 | 15.97 | 12 | 03 | 11.78 |
| | 1 | 18 | 46 | 53.39 | 22 | 59 | 57.47 | 0.983 2649 | 16 | 15.98 | 12 | 03 | 40.02 |
| | 2 | 18 | 51 | 18.02 | 22 | 54 | 47.27 | 0.983 2581 | 16 | 15.98 | 12 | 04 | 07.95 |
| | 3 | 18 | 55 | 42.33 | 22 | 49 | 09.73 | 0.983 2576 | 16 | 15.99 | 12 | 04 | 35.52 |
| | 4 | 19 | 00 | 06.26 | 22 | 43 | 04.99 | 0.983 2632 | 16 | 15.98 | 12 | 05 | 02.72 |
| | 5 | 19 | 04 | 29.81 | 22 | 36 | 33.22 | 0.983 2747 | 16 | 15.97 | 12 | 05 | 29.52 |
| Jan | 6 | 19 | 08 | 52.94 | -22 | 29 | 34.59 | 0.983 2918 | 16 | 15.95 | 12 | 05 | 55.88 |
| | 7 | 19 | 13 | 15.63 | 22 | 22 | 09.28 | 0.983 3141 | 16 | 15.93 | 12 | 06 | 21.80 |
| | 8 | 19 | 17 | 37.86 | 22 | 14 | 17.52 | 0.983 3413 | 16 | 15.90 | 12 | 06 | 47.24 |
| | 9 | 19 | 21 | 59.60 | 22 | 05 | 59.51 | 0.983 3731 | 16 | 15.87 | 12 | 07 | 12.16 |
| | 10 | 19 | 26 | 20.82 | 21 | 57 | 15.50 | 0.983 4091 | 16 | 15.83 | 12 | 07 | 36.55 |
| | 11 | 19 | 30 | 41.49 | 21 | 48 | 05.76 | 0.983 4491 | 16 | 15.80 | 12 | 08 | 00.38 |
| | 12 | 19 | 35 | 01.59 | -21 | 38 | 30.56 | 0.983 4928 | 16 | 15.75 | 12 | 08 | 23.62 |
| | 13 | 19 | 39 | 21.09 | 21 | 28 | 30.17 | 0.983 5402 | 16 | 15.70 | 12 | 08 | 46.24 |
| | 14 | 19 | 43 | 39.95 | 21 | 18 | 04.88 | 0.983 5911 | 16 | 15.65 | 12 | 09 | 08.22 |
| | 15 | 19 | 47 | 58.15 | 21 | 07 | 14.99 | 0.983 6456 | 16 | 15.60 | 12 | 09 | 29.52 |
| | 16 | 19 | 52 | 15.67 | 20 | 56 | 00.81 | 0.983 7039 | 16 | 15.54 | 12 | 09 | 50.14 |
| | 17 | 19 | 56 | 32.49 | 20 | 44 | 22.64 | 0.983 7660 | 16 | 15.48 | 12 | 10 | 10.04 |
| | 18 | 20 | 00 | 48.58 | -20 | 32 | 20.82 | 0.983 8322 | 16 | 15.42 | 12 | 10 | 29.22 |
| | 19 | 20 | 05 | 03.94 | 20 | 19 | 55.67 | 0.983 9027 | 16 | 15.35 | 12 | 10 | 47.65 |
| | 20 | 20 | 09 | 18.54 | 20 | 07 | 07.55 | 0.983 9777 | 16 | 15.27 | 12 | 11 | 05.32 |
| | 21 | 20 | 13 | 32.38 | 19 | 53 | 56.81 | 0.984 0574 | 16 | 15.19 | 12 | 11 | 22.22 |
| | 22 | 20 | 17 | 45.45 | 19 | 40 | 23.80 | 0.984 1419 | 16 | 15.11 | 12 | 11 | 38.33 |
| | 23 | 20 | 21 | 57.73 | 19 | 26 | 28.91 | 0.984 2316 | 16 | 15.02 | 12 | 11 | 53.66 |
| | 24 | 20 | 26 | 09.21 | -19 | 12 | 12.51 | 0.984 3266 | 16 | 14.93 | 12 | 12 | 08.18 |
| | 25 | 20 | 30 | 19.90 | 18 | 57 | 34.97 | 0.984 4270 | 16 | 14.83 | 12 | 12 | 21.90 |
| | 26 | 20 | 34 | 29.78 | 18 | 42 | 36.69 | 0.984 5331 | 16 | 14.72 | 12 | 12 | 34.80 |
| | 27 | 20 | 38 | 38.85 | 18 | 27 | 18.05 | 0.984 6450 | 16 | 14.61 | 12 | 12 | 46.90 |
| | 28 | 20 | 42 | 47.10 | 18 | 11 | 39.43 | 0.984 7628 | 16 | 14.49 | 12 | 12 | 58.18 |
| | 29 | 20 | 46 | 54.54 | 17 | 55 | 41.22 | 0.984 8866 | 16 | 14.37 | 12 | 13 | 08.64 |
| | 30 | 20 | 51 | 01.16 | -17 | 39 | 23.80 | 0.985 0163 | 16 | 14.24 | 12 | 13 | 18.30 |
| | 31 | 20 | 55 | 06.97 | 17 | 22 | 47.56 | 0.985 1521 | 16 | 14.11 | 12 | 13 | 27.14 |
| Feb | 1 | 20 | 59 | 11.97 | 17 | 05 | 52.85 | 0.985 2936 | 16 | 13.97 | 12 | 13 | 35.18 |
| | 2 | 21 | 03 | 16.17 | 16 | 48 | 40.06 | 0.985 4407 | 16 | 13.82 | 12 | 13 | 42.43 |
| | 3 | 21 | 07 | 19.57 | 16 | 31 | 09.55 | 0.985 5931 | 16 | 13.67 | 12 | 13 | 48.87 |
| | 4 | 21 | 11 | 22.18 | 16 | 13 | 21.73 | 0.985 7504 | 16 | 13.52 | 12 | 13 | 54.53 |
| | 5 | 21 | 15 | 24.00 | -15 | 55 | 16.98 | 0.985 9124 | 16 | 13.36 | 12 | 13 | 59.39 |
| | 6 | 21 | 19 | 25.04 | 15 | 36 | 55.70 | 0.986 0784 | 16 | 13.19 | 12 | 14 | 03.48 |
| | 7 | 21 | 23 | 25.30 | 15 | 18 | 18.32 | 0.986 2483 | 16 | 13.03 | 12 | 14 | 06.78 |
| | 8 | 21 | 27 | 24.79 | 14 | 59 | 25.25 | 0.986 4216 | 16 | 12.85 | 12 | 14 | 09.31 |
| | 9 | 21 | 31 | 23.50 | 14 | 40 | 16.94 | 0.986 5981 | 16 | 12.68 | 12 | 14 | 11.06 |
| | 10 | 21 | 35 | 21.43 | 14 | 20 | 53.80 | 0.986 7773 | 16 | 12.50 | 12 | 14 | 12.04 |
| | 11 | 21 | 39 | 18.60 | -14 | 01 | 16.27 | 0.986 9593 | 16 | 12.32 | 12 | 14 | 12.26 |
| | 12 | 21 | 43 | 15.00 | 13 | 41 | 24.78 | 0.987 1438 | 16 | 12.14 | 12 | 14 | 11.72 |
| | 13 | 21 | 47 | 10.63 | 13 | 21 | 19.76 | 0.987 3309 | 16 | 11.96 | 12 | 14 | 10.42 |
| | 14 | 21 | 51 | 05.52 | 13 | 01 | 01.64 | 0.987 5205 | 16 | 11.77 | 12 | 14 | 08.37 |
| | 15 | 21 | 54 | 59.65 | -12 | 40 | 30.84 | 0.987 7126 | 16 | 11.58 | 12 | 14 | 05.58 |

**SUN, 2021**

FOR $0^h$ TERRESTRIAL TIME

| Date | | Geometric Longitude* (Mean Equinox of date ) | | | Latitude ( Ecliptic of date ) | Apparent Longitude (True equinox of date) | | | Aberration | Prec. in Long. ( J 2021.5 of date ) | Nut. in Long. | Nut. in Obliquity | True Obliquity (23° 26') |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | " | ° | ' | " | " | " | " | " | " |
| Feb | 15 | 326 | 31 | 42.72 | -0.47 | 326 | 31 | 06.74 | 20.75 | -19.09 | -15.27 | +2.57 | 14.08 |
| | 16 | 327 | 32 | 19.84 | 0.40 | 327 | 31 | 43.75 | 20.75 | 18.95 | 15.39 | 2.59 | 14.10 |
| | 17 | 328 | 32 | 55.26 | 0.32 | 328 | 32 | 19.07 | 20.74 | 18.81 | 15.50 | 2.59 | 14.10 |
| | 18 | 329 | 33 | 28.96 | 0.22 | 329 | 32 | 52.69 | 20.74 | 18.67 | 15.58 | 2.58 | 14.09 |
| | 19 | 330 | 34 | 00.86 | -0.11 | 330 | 33 | 24.55 | 20.73 | 18.54 | 15.62 | 2.57 | 14.07 |
| | 20 | 331 | 34 | 30.96 | 0.00 | 331 | 33 | 54.65 | 20.73 | 18.40 | 15.63 | 2.55 | 14.06 |
| | 21 | 332 | 34 | 59.22 | +0.14 | 332 | 34 | 22.94 | 20.72 | -18.26 | -15.60 | +2.54 | 14.05 |
| | 22 | 333 | 35 | 25.58 | 0.25 | 333 | 34 | 49.37 | 20.72 | 18.12 | 15.54 | 2.54 | 14.05 |
| | 23 | 334 | 35 | 50.09 | 0.40 | 334 | 35 | 13.96 | 20.72 | 17.98 | 15.47 | 2.57 | 14.07 |
| | 24 | 335 | 36 | 12.74 | 0.50 | 335 | 35 | 36.67 | 20.71 | 17.84 | 15.40 | 2.61 | 14.11 |
| | 25 | 336 | 36 | 33.50 | 0.61 | 336 | 35 | 57.48 | 20.71 | 17.70 | 15.36 | 2.67 | 14.17 |
| | 26 | 337 | 36 | 52.43 | 0.68 | 337 | 36 | 16.42 | 20.70 | 17.56 | 15.35 | 2.74 | 14.24 |
| | 27 | 338 | 37 | 09.54 | +0.72 | 338 | 36 | 33.48 | 20.70 | -17.42 | -15.41 | +2.81 | 14.31 |
| | 28 | 339 | 37 | 24.90 | 0.72 | 339 | 36 | 48.74 | 20.69 | 17.29 | 15.51 | 2.87 | 14.37 |
| Mar | 1 | 340 | 37 | 38.53 | 0.68 | 340 | 37 | 02.24 | 20.69 | 17.15 | 15.65 | 2.91 | 14.41 |
| | 2 | 341 | 37 | 50.55 | 0.65 | 341 | 37 | 14.12 | 20.68 | 17.01 | 15.79 | 2.93 | 14.42 |
| | 3 | 342 | 38 | 00.95 | 0.58 | 342 | 37 | 24.42 | 20.68 | 16.87 | 15.90 | 2.91 | 14.40 |
| | 4 | 343 | 38 | 09.83 | 0.47 | 343 | 37 | 33.24 | 20.67 | 16.73 | 15.96 | 2.88 | 14.37 |
| | 5 | 344 | 38 | 17.13 | +0.36 | 344 | 37 | 40.55 | 20.67 | -16.59 | -15.97 | +2.84 | 14.33 |
| | 6 | 345 | 38 | 22.94 | 0.22 | 345 | 37 | 46.42 | 20.66 | 16.45 | 15.91 | 2.82 | 14.31 |
| | 7 | 346 | 38 | 27.21 | +0.07 | 346 | 37 | 50.77 | 20.65 | 16.31 | 15.83 | 2.81 | 14.30 |
| | 8 | 347 | 38 | 29.93 | -0.04 | 347 | 37 | 53.58 | 20.65 | 16.17 | 15.74 | 2.83 | 14.32 |
| | 9 | 348 | 38 | 31.01 | 0.14 | 348 | 37 | 54.73 | 20.64 | 16.03 | 15.68 | 2.87 | 14.36 |
| | 10 | 349 | 38 | 30.43 | 0.22 | 349 | 37 | 54.19 | 20.64 | 15.90 | 15.65 | 2.93 | 14.41 |
| | 11 | 350 | 38 | 28.15 | -0.29 | 350 | 37 | 51.89 | 20.63 | -15.76 | -15.68 | +2.99 | 14.47 |
| | 12 | 351 | 38 | 24.08 | 0.32 | 351 | 37 | 47.75 | 20.63 | 15.62 | 15.76 | 3.05 | 14.53 |
| | 13 | 352 | 38 | 18.15 | 0.32 | 352 | 37 | 41.70 | 20.62 | 15.48 | 15.87 | 3.09 | 14.57 |
| | 14 | 353 | 38 | 10.30 | 0.32 | 353 | 37 | 33.71 | 20.62 | 15.34 | 16.02 | 3.12 | 14.60 |
| | 15 | 354 | 38 | 00.43 | 0.29 | 354 | 37 | 23.70 | 20.61 | 15.20 | 16.17 | 3.13 | 14.61 |
| | 16 | 355 | 37 | 48.54 | 0.22 | 355 | 37 | 11.68 | 20.60 | 15.06 | 16.31 | 3.12 | 14.60 |
| | 17 | 356 | 37 | 34.54 | -0.11 | 356 | 36 | 57.56 | 20.60 | -14.92 | -16.42 | +3.10 | 14.57 |
| | 18 | 357 | 37 | 18.37 | 0.00 | 357 | 36 | 41.33 | 20.59 | 14.78 | 16.50 | 3.07 | 14.54 |
| | 19 | 358 | 37 | 00.01 | +0.11 | 358 | 36 | 22.93 | 20.59 | 14.64 | 16.54 | 3.03 | 14.51 |
| | 20 | 359 | 36 | 39.42 | 0.25 | 359 | 36 | 02.34 | 20.58 | 14.51 | 16.54 | 3.01 | 14.48 |
| | 21 | 0 | 36 | 16.56 | 0.40 | 0 | 35 | 39.52 | 20.58 | 14.37 | 16.51 | 2.99 | 14.46 |
| | 22 | 1 | 35 | 51.42 | 0.50 | 1 | 35 | 14.42 | 20.57 | 14.23 | 16.47 | 2.99 | 14.45 |
| | 23 | 2 | 35 | 23.96 | +0.61 | 2 | 34 | 47.03 | 20.57 | -14.09 | -16.42 | +3.00 | 14.47 |
| | 24 | 3 | 34 | 54.22 | 0.72 | 3 | 34 | 17.33 | 20.56 | 13.95 | 16.38 | 3.04 | 14.50 |
| | 25 | 4 | 34 | 22.17 | 0.79 | 4 | 33 | 45.29 | 20.55 | 13.81 | 16.37 | 3.09 | 14.55 |
| | 26 | 5 | 33 | 47.86 | 0.83 | 5 | 33 | 10.94 | 20.55 | 13.67 | 16.42 | 3.14 | 14.60 |
| | 27 | 6 | 33 | 11.34 | 0.83 | 6 | 32 | 34.33 | 20.54 | 13.53 | 16.51 | 3.19 | 14.65 |
| | 28 | 7 | 32 | 32.62 | 0.83 | 7 | 31 | 55.49 | 20.54 | 13.39 | 16.65 | 3.23 | 14.69 |
| | 29 | 8 | 31 | 51.80 | +0.76 | 8 | 31 | 14.52 | 20.53 | -13.26 | -16.80 | +3.23 | 14.69 |
| | 30 | 9 | 31 | 08.99 | 0.68 | 9 | 30 | 31.57 | 20.52 | 13.12 | 16.93 | 3.21 | 14.67 |
| | 31 | 10 | 30 | 24.17 | 0.58 | 10 | 29 | 46.68 | 20.52 | 12.98 | 17.02 | 3.16 | 14.62 |
| Apr | 1 | 11 | 29 | 37.49 | 0.47 | 11 | 28 | 59.99 | 20.51 | 12.84 | 17.04 | 3.10 | 14.56 |
| | 2 | 12 | 28 | 49.02 | +0.32 | 12 | 28 | 11.57 | 20.51 | -12.70 | -16.99 | +3.06 | 14.51 |

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -18' 01".251 and subtract precession from J 2021.5.

**SUN, 2021**

FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Semi Diameter | | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | ' | " | h | m | s |
| Feb | 15 | 21 | 54 | 59.65 | -12 | 40 | 30.84 | 0.987 7126 | 16 | 11.58 | 12 | 14 | 05.58 |
| | 16 | 21 | 58 | 53.05 | 12 | 19 | 47.80 | 0.987 9075 | 16 | 11.39 | 12 | 14 | 02.06 |
| | 17 | 22 | 02 | 45.73 | 11 | 58 | 52.94 | 0.988 1052 | 16 | 11.20 | 12 | 13 | 57.83 |
| | 18 | 22 | 06 | 37.69 | 11 | 37 | 46.69 | 0.988 3058 | 16 | 11.00 | 12 | 13 | 52.88 |
| | 19 | 22 | 10 | 28.96 | 11 | 16 | 29.48 | 0.988 5095 | 16 | 10.80 | 12 | 13 | 47.24 |
| | 20 | 22 | 14 | 19.53 | 10 | 55 | 01.74 | 0.988 7165 | 16 | 10.60 | 12 | 13 | 40.92 |
| | 21 | 22 | 18 | 09.44 | -10 | 33 | 23.89 | 0.988 9269 | 16 | 10.39 | 12 | 13 | 33.93 |
| | 22 | 22 | 21 | 58.69 | 10 | 11 | 36.34 | 0.989 1409 | 16 | 10.18 | 12 | 13 | 26.29 |
| | 23 | 22 | 25 | 47.30 | 9 | 49 | 39.53 | 0.989 3586 | 16 | 09.97 | 12 | 13 | 18.02 |
| | 24 | 22 | 29 | 35.28 | 9 | 27 | 33.86 | 0.989 5803 | 16 | 09.75 | 12 | 13 | 09.14 |
| | 25 | 22 | 33 | 22.66 | 9 | 05 | 19.73 | 0.989 8061 | 16 | 09.53 | 12 | 12 | 59.66 |
| | 26 | 22 | 37 | 09.45 | 8 | 42 | 57.56 | 0.990 0361 | 16 | 09.30 | 12 | 12 | 49.60 |
| | 27 | 22 | 40 | 55.67 | -8 | 20 | 27.71 | 0.990 2704 | 16 | 09.07 | 12 | 12 | 38.99 |
| | 28 | 22 | 44 | 41.34 | 7 | 57 | 50.58 | 0.990 5091 | 16 | 08.84 | 12 | 12 | 27.84 |
| Mar | 1 | 22 | 48 | 26.49 | 7 | 35 | 06.51 | 0.990 7520 | 16 | 08.60 | 12 | 12 | 16.19 |
| | 2 | 22 | 52 | 11.14 | 7 | 12 | 15.87 | 0.990 9992 | 16 | 08.36 | 12 | 12 | 04.05 |
| | 3 | 22 | 55 | 55.31 | 6 | 49 | 19.01 | 0.991 2502 | 16 | 08.12 | 12 | 11 | 51.44 |
| | 4 | 22 | 59 | 39.03 | 6 | 26 | 16.29 | 0.991 5048 | 16 | 07.87 | 12 | 11 | 38.39 |
| | 5 | 23 | 03 | 22.33 | -6 | 03 | 08.08 | 0.991 7626 | 16 | 07.62 | 12 | 11 | 24.92 |
| | 6 | 23 | 07 | 05.21 | 5 | 39 | 54.75 | 0.992 0231 | 16 | 07.36 | 12 | 11 | 11.05 |
| | 7 | 23 | 10 | 47.70 | 5 | 16 | 36.70 | 0.992 2860 | 16 | 07.11 | 12 | 10 | 56.79 |
| | 8 | 23 | 14 | 29.82 | 4 | 53 | 14.32 | 0.992 5509 | 16 | 06.85 | 12 | 10 | 42.16 |
| | 9 | 23 | 18 | 11.58 | 4 | 29 | 48.00 | 0.992 8173 | 16 | 06.59 | 12 | 10 | 27.19 |
| | 10 | 23 | 21 | 52.99 | 4 | 06 | 18.14 | 0.993 0849 | 16 | 06.33 | 12 | 10 | 11.88 |
| | 11 | 23 | 25 | 34.08 | -3 | 42 | 45.14 | 0.993 3535 | 16 | 06.07 | 12 | 09 | 56.26 |
| | 12 | 23 | 29 | 14.86 | 3 | 19 | 09.40 | 0.993 6229 | 16 | 05.80 | 12 | 09 | 40.34 |
| | 13 | 23 | 32 | 55.34 | 2 | 55 | 31.30 | 0.993 8928 | 16 | 05.54 | 12 | 09 | 24.14 |
| | 14 | 23 | 36 | 35.55 | 2 | 31 | 51.25 | 0.994 1632 | 16 | 05.28 | 12 | 09 | 07.68 |
| | 15 | 23 | 40 | 15.50 | 2 | 08 | 09.63 | 0.994 4340 | 16 | 05.02 | 12 | 08 | 50.96 |
| | 16 | 23 | 43 | 55.22 | 1 | 44 | 26.84 | 0.994 7052 | 16 | 04.75 | 12 | 08 | 34.02 |
| | 17 | 23 | 47 | 34.71 | -1 | 20 | 43.25 | 0.994 9768 | 16 | 04.49 | 12 | 08 | 16.86 |
| | 18 | 23 | 51 | 14.00 | +0 | 56 | 59.25 | 0.995 2489 | 16 | 04.23 | 12 | 07 | 59.51 |
| | 19 | 23 | 54 | 53.11 | 0 | 33 | 15.24 | 0.995 5216 | 16 | 03.96 | 12 | 07 | 41.98 |
| | 20 | 23 | 58 | 32.06 | 0 | 09 | 31.59 | 0.995 7949 | 16 | 03.70 | 12 | 07 | 24.30 |
| | 21 | 0 | 02 | 10.86 | 0 | 14 | 11.31 | 0.996 0690 | 16 | 03.43 | 12 | 07 | 06.48 |
| | 22 | 0 | 05 | 49.53 | 0 | 37 | 53.10 | 0.996 3441 | 16 | 03.17 | 12 | 06 | 48.54 |
| | 23 | 0 | 09 | 28.10 | +1 | 01 | 33.39 | 0.996 6202 | 16 | 02.90 | 12 | 06 | 30.51 |
| | 24 | 0 | 13 | 06.58 | 1 | 25 | 11.81 | 0.996 8976 | 16 | 02.63 | 12 | 06 | 12.40 |
| | 25 | 0 | 16 | 44.99 | 1 | 48 | 48.01 | 0.997 1765 | 16 | 02.36 | 12 | 05 | 54.24 |
| | 26 | 0 | 20 | 23.36 | 2 | 12 | 21.61 | 0.997 4570 | 16 | 02.09 | 12 | 05 | 36.04 |
| | 27 | 0 | 24 | 01.70 | 2 | 35 | 52.29 | 0.997 7394 | 16 | 01.82 | 12 | 05 | 17.83 |
| | 28 | 0 | 27 | 40.04 | 2 | 59 | 19.71 | 0.998 0237 | 16 | 01.55 | 12 | 04 | 59.64 |
| | 29 | 0 | 31 | 18.41 | +3 | 22 | 43.54 | 0.998 3100 | 16 | 01.27 | 12 | 04 | 41.49 |
| | 30 | 0 | 34 | 56.83 | 3 | 46 | 03.49 | 0.998 5983 | 16 | 00.99 | 12 | 04 | 23.41 |
| | 31 | 0 | 38 | 35.33 | 4 | 09 | 19.25 | 0.998 8885 | 16 | 00.71 | 12 | 04 | 05.41 |
| Apr | 1 | 0 | 42 | 13.94 | 4 | 32 | 30.52 | 0.999 1803 | 16 | 00.43 | 12 | 03 | 47.52 |
| | 2 | 0 | 45 | 52.67 | +4 | 55 | 36.99 | 0.999 4733 | 16 | 00.15 | 12 | 03 | 29.77 |

**SUN, 2021**

FOR $0^h$ TERRESTRIAL TIME

| Date | | Geometric Longitude* (Mean Equinox of date) | | | Latitude (Ecliptic of date) | Apparent Longitude (True equinox of date) | | | Aberration | Prec. in Long. (J 2021.5 of date) | Nut. in Long. | Nut. in Obliquity | True Obliquity (23° 26') |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | " | ° | ' | " | " | " | " | " | " |
| Apr | 1 | 11 | 29 | 37.49 | +0.47 | 11 | 28 | 59.99 | 20.51 | -12.84 | -17.04 | +3.10 | 14.56 |
| | 2 | 12 | 28 | 49.02 | 0.32 | 12 | 28 | 11.57 | 20.51 | 12.70 | 16.99 | 3.06 | 14.51 |
| | 3 | 13 | 27 | 58.78 | 0.18 | 13 | 27 | 21.42 | 20.50 | 12.56 | 16.90 | 3.02 | 14.48 |
| | 4 | 14 | 27 | 06.80 | +0.07 | 14 | 26 | 29.54 | 20.49 | 12.42 | 16.81 | 3.02 | 14.47 |
| | 5 | 15 | 26 | 13.07 | -0.04 | 15 | 25 | 35.90 | 20.49 | 12.28 | 16.73 | 3.04 | 14.49 |
| | 6 | 16 | 25 | 17.62 | 0.14 | 16 | 24 | 40.50 | 20.48 | 12.14 | 16.69 | 3.07 | 14.52 |
| | 7 | 17 | 24 | 20.39 | -0.22 | 17 | 23 | 43.26 | 20.48 | -12.00 | -16.70 | +3.11 | 14.56 |
| | 8 | 18 | 23 | 21.40 | 0.25 | 18 | 22 | 44.22 | 20.47 | 11.87 | 16.76 | 3.16 | 14.60 |
| | 9 | 19 | 22 | 20.55 | 0.25 | 19 | 21 | 43.27 | 20.46 | 11.73 | 16.86 | 3.19 | 14.63 |
| | 10 | 20 | 21 | 17.85 | 0.25 | 20 | 20 | 40.45 | 20.46 | 11.59 | 16.99 | 3.20 | 14.65 |
| | 11 | 21 | 20 | 13.26 | 0.18 | 21 | 19 | 35.72 | 20.45 | 11.45 | 17.13 | 3.20 | 14.64 |
| | 12 | 22 | 19 | 06.68 | 0.14 | 22 | 18 | 29.02 | 20.45 | 11.31 | 17.26 | 3.18 | 14.62 |
| | 13 | 23 | 17 | 58.13 | -0.04 | 23 | 17 | 20.36 | 20.44 | -11.17 | -17.37 | +3.14 | 14.58 |
| | 14 | 24 | 16 | 47.53 | +0.07 | 24 | 16 | 09.70 | 20.44 | 11.03 | 17.44 | 3.10 | 14.54 |
| | 15 | 25 | 15 | 34.84 | 0.18 | 25 | 14 | 56.98 | 20.43 | 10.89 | 17.48 | 3.05 | 14.48 |
| | 16 | 26 | 14 | 20.06 | 0.32 | 26 | 13 | 42.20 | 20.42 | 10.75 | 17.48 | 3.00 | 14.44 |
| | 17 | 27 | 13 | 03.12 | 0.43 | 27 | 12 | 25.31 | 20.42 | 10.61 | 17.44 | 2.97 | 14.40 |
| | 18 | 28 | 11 | 44.00 | 0.58 | 28 | 11 | 06.25 | 20.41 | 10.48 | 17.38 | 2.94 | 14.38 |
| | 19 | 29 | 10 | 22.71 | +0.68 | 29 | 09 | 45.04 | 20.41 | -10.34 | -17.31 | +2.94 | 14.37 |
| | 20 | 30 | 08 | 59.20 | 0.79 | 30 | 08 | 21.59 | 20.40 | 10.20 | 17.25 | 2.95 | 14.38 |
| | 21 | 31 | 07 | 33.48 | 0.86 | 31 | 06 | 55.91 | 20.40 | 10.06 | 17.22 | 2.98 | 14.41 |
| | 22 | 32 | 06 | 05.56 | 0.90 | 32 | 05 | 28.00 | 20.39 | 9.92 | 17.22 | 3.02 | 14.45 |
| | 23 | 33 | 04 | 35.50 | 0.94 | 33 | 03 | 57.89 | 20.39 | 9.78 | 17.27 | 3.06 | 14.48 |
| | 24 | 34 | 03 | 03.25 | 0.90 | 34 | 02 | 25.55 | 20.38 | 9.64 | 17.36 | 3.09 | 14.51 |
| | 25 | 35 | 01 | 28.90 | +0.86 | 35 | 00 | 51.08 | 20.37 | -9.50 | -17.49 | +3.09 | 14.52 |
| | 26 | 35 | 59 | 52.53 | 0.79 | 35 | 59 | 14.60 | 20.37 | 9.36 | 17.61 | 3.07 | 14.49 |
| | 27 | 36 | 58 | 14.22 | 0.68 | 36 | 57 | 36.22 | 20.36 | 9.23 | 17.69 | 3.02 | 14.44 |
| | 28 | 37 | 56 | 34.08 | 0.54 | 37 | 55 | 56.06 | 20.36 | 9.09 | 17.70 | 2.95 | 14.37 |
| | 29 | 38 | 54 | 52.17 | 0.43 | 38 | 54 | 14.22 | 20.35 | 8.95 | 17.64 | 2.88 | 14.30 |
| | 30 | 39 | 53 | 08.62 | 0.29 | 39 | 52 | 30.79 | 20.35 | 8.81 | 17.53 | 2.83 | 14.25 |
| May | 1 | 40 | 51 | 23.53 | +0.14 | 40 | 50 | 45.85 | 20.34 | -8.67 | -17.38 | +2.81 | 14.22 |
| | 2 | 41 | 49 | 36.91 | 0.04 | 41 | 48 | 59.36 | 20.34 | 8.53 | 17.25 | 2.81 | 14.23 |
| | 3 | 42 | 47 | 48.80 | 0.07 | 42 | 47 | 11.36 | 20.33 | 8.39 | 17.15 | 2.84 | 14.25 |
| | 4 | 43 | 45 | 59.28 | 0.14 | 43 | 45 | 21.89 | 20.33 | 8.25 | 17.11 | 2.87 | 14.28 |
| | 5 | 44 | 44 | 08.30 | 0.22 | 44 | 43 | 30.90 | 20.32 | 8.11 | 17.12 | 2.91 | 14.32 |
| | 6 | 45 | 42 | 15.93 | +0.22 | 45 | 41 | 38.47 | 20.32 | 7.97 | 17.18 | 2.94 | 14.35 |
| | 7 | 46 | 40 | 22.14 | -0.22 | 46 | 39 | 44.60 | 20.31 | -7.84 | -17.27 | +2.95 | 14.36 |
| | 8 | 47 | 38 | 26.90 | 0.18 | 47 | 37 | 49.26 | 20.31 | 7.70 | 17.38 | 2.95 | 14.35 |
| | 9 | 48 | 36 | 30.17 | 0.11 | 48 | 35 | 52.44 | 20.30 | 7.56 | 17.47 | 2.92 | 14.33 |
| | 10 | 49 | 34 | 31.95 | -0.04 | 49 | 33 | 54.14 | 20.30 | 7.42 | 17.55 | 2.89 | 14.29 |
| | 11 | 50 | 32 | 32.26 | +0.07 | 50 | 31 | 54.41 | 20.29 | 7.28 | 17.60 | 2.84 | 14.24 |
| | 12 | 51 | 30 | 31.01 | 0.18 | 51 | 29 | 53.16 | 20.29 | 7.14 | 17.61 | 2.78 | 14.19 |
| | 13 | 52 | 28 | 28.18 | +0.32 | 52 | 27 | 50.36 | 20.28 | -7.00 | -17.58 | +2.73 | 14.13 |
| | 14 | 53 | 26 | 23.76 | 0.43 | 53 | 25 | 46.02 | 20.28 | 6.86 | 17.51 | 2.69 | 14.09 |
| | 15 | 54 | 24 | 17.74 | 0.58 | 54 | 23 | 40.09 | 20.28 | 6.72 | 17.42 | 2.66 | 14.06 |
| | 16 | 55 | 22 | 10.08 | 0.68 | 55 | 21 | 32.54 | 20.27 | 6.58 | 17.31 | 2.65 | 14.05 |
| | 17 | 56 | 20 | 00.78 | +0.79 | 56 | 19 | 23.34 | 20.27 | -6.45 | -17.22 | +2.66 | 14.05 |

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -18' 01".251 and subtract precession from J 2021.5.

**SUN, 2021**

FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Semi Diameter | | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | ' | " | h | m | s |
| Apr | 1 | 0 | 42 | 13.94 | +4 | 32 | 30.52 | 0.999 1803 | 16 | 00.43 | 12 | 03 | 47.52 |
| | 2 | 0 | 45 | 52.67 | 4 | 55 | 36.99 | 0.999 4733 | 16 | 00.15 | 12 | 03 | 29.77 |
| | 3 | 0 | 49 | 31.55 | 5 | 18 | 38.31 | 0.999 7672 | 15 | 59.87 | 12 | 03 | 12.17 |
| | 4 | 0 | 53 | 10.59 | 5 | 41 | 34.15 | 1.000 0616 | 15 | 59.59 | 12 | 02 | 54.75 |
| | 5 | 0 | 56 | 49.82 | 6 | 04 | 24.16 | 1.000 3560 | 15 | 59.30 | 12 | 02 | 37.51 |
| | 6 | 1 | 00 | 29.24 | 6 | 27 | 07.99 | 1.000 6500 | 15 | 59.02 | 12 | 02 | 20.49 |
| | 7 | 1 | 04 | 08.88 | +6 | 49 | 45.28 | 1.000 9432 | 15 | 58.74 | 12 | 02 | 03.69 |
| | 8 | 1 | 07 | 48.75 | 7 | 12 | 15.67 | 1.001 2354 | 15 | 58.46 | 12 | 01 | 47.14 |
| | 9 | 1 | 11 | 28.86 | 7 | 34 | 38.81 | 1.001 5262 | 15 | 58.18 | 12 | 01 | 30.83 |
| | 10 | 1 | 15 | 09.24 | 7 | 56 | 54.34 | 1.001 8154 | 15 | 57.91 | 12 | 01 | 14.81 |
| | 11 | 1 | 18 | 49.90 | 8 | 19 | 01.90 | 1.002 1028 | 15 | 57.63 | 12 | 00 | 59.06 |
| | 12 | 1 | 22 | 30.84 | 8 | 41 | 01.13 | 1.002 3883 | 15 | 57.36 | 12 | 00 | 43.61 |
| | 13 | 1 | 26 | 12.10 | +9 | 02 | 51.69 | 1.002 6717 | 15 | 57.09 | 12 | 00 | 28.48 |
| | 14 | 1 | 29 | 53.67 | 9 | 24 | 33.21 | 1.002 9531 | 15 | 56.82 | 12 | 00 | 13.67 |
| | 15 | 1 | 33 | 35.58 | 9 | 46 | 05.33 | 1.003 2324 | 15 | 56.55 | 11 | 59 | 59.19 |
| | 16 | 1 | 37 | 17.83 | 10 | 07 | 27.72 | 1.003 5095 | 15 | 56.29 | 11 | 59 | 45.07 |
| | 17 | 1 | 41 | 00.44 | 10 | 28 | 40.00 | 1.003 7847 | 15 | 56.03 | 11 | 59 | 31.31 |
| | 18 | 1 | 44 | 43.43 | 10 | 49 | 41.82 | 1.004 0579 | 15 | 55.77 | 11 | 59 | 17.93 |
| | 19 | 1 | 48 | 26.79 | +11 | 10 | 32.84 | 1.004 3293 | 15 | 55.51 | 11 | 59 | 04.93 |
| | 20 | 1 | 52 | 10.55 | 11 | 31 | 12.71 | 1.004 5990 | 15 | 55.25 | 11 | 58 | 52.33 |
| | 21 | 1 | 55 | 54.71 | 11 | 51 | 41.07 | 1.004 8671 | 15 | 55.00 | 11 | 58 | 40.14 |
| | 22 | 1 | 59 | 39.29 | 12 | 11 | 57.60 | 1.005 1340 | 15 | 54.74 | 11 | 58 | 28.38 |
| | 23 | 2 | 03 | 24.29 | 12 | 32 | 01.94 | 1.005 3997 | 15 | 54.49 | 11 | 58 | 17.06 |
| | 24 | 2 | 07 | 09.74 | 12 | 51 | 53.78 | 1.005 6646 | 15 | 54.24 | 11 | 58 | 06.18 |
| | 25 | 2 | 10 | 55.65 | +13 | 11 | 32.79 | 1.005 9288 | 15 | 53.99 | 11 | 57 | 55.77 |
| | 26 | 2 | 14 | 42.02 | 13 | 30 | 58.69 | 1.006 1925 | 15 | 53.74 | 11 | 57 | 45.84 |
| | 27 | 2 | 18 | 28.89 | 13 | 50 | 11.19 | 1.006 4559 | 15 | 53.49 | 11 | 57 | 36.41 |
| | 28 | 2 | 22 | 16.26 | 14 | 09 | 10.01 | 1.006 7189 | 15 | 53.24 | 11 | 57 | 27.49 |
| | 29 | 2 | 26 | 04.16 | 14 | 27 | 54.87 | 1.006 9815 | 15 | 52.99 | 11 | 57 | 19.09 |
| | 30 | 2 | 29 | 52.59 | 14 | 46 | 25.49 | 1.007 2435 | 15 | 52.74 | 11 | 57 | 11.22 |
| May | 1 | 2 | 33 | 41.56 | +15 | 04 | 41.58 | 1.007 5044 | 15 | 52.50 | 11 | 57 | 03.91 |
| | 2 | 2 | 37 | 31.09 | 15 | 22 | 42.82 | 1.007 7640 | 15 | 52.25 | 11 | 56 | 57.15 |
| | 3 | 2 | 41 | 21.17 | 15 | 40 | 28.91 | 1.008 0218 | 15 | 52.01 | 11 | 56 | 50.95 |
| | 4 | 2 | 45 | 11.82 | 15 | 57 | 59.52 | 1.008 2775 | 15 | 51.77 | 11 | 56 | 45.33 |
| | 5 | 2 | 49 | 03.04 | 16 | 15 | 14.32 | 1.008 5306 | 15 | 51.53 | 11 | 56 | 40.28 |
| | 6 | 2 | 52 | 54.83 | 16 | 32 | 13.01 | 1.008 7809 | 15 | 51.29 | 11 | 56 | 35.81 |
| | 7 | 2 | 56 | 47.20 | +16 | 48 | 55.27 | 1.009 0279 | 15 | 51.06 | 11 | 56 | 31.91 |
| | 8 | 3 | 00 | 40.15 | 17 | 05 | 20.77 | 1.009 2715 | 15 | 50.83 | 11 | 56 | 28.60 |
| | 9 | 3 | 04 | 33.68 | 17 | 21 | 29.21 | 1.009 5113 | 15 | 50.60 | 11 | 56 | 25.87 |
| | 10 | 3 | 08 | 27.79 | 17 | 37 | 20.27 | 1.009 7473 | 15 | 50.38 | 11 | 56 | 23.72 |
| | 11 | 3 | 12 | 22.48 | 17 | 52 | 53.64 | 1.009 9792 | 15 | 50.16 | 11 | 56 | 22.15 |
| | 12 | 3 | 16 | 17.75 | 18 | 08 | 09.03 | 1.010 2069 | 15 | 49.95 | 11 | 56 | 21.15 |
| | 13 | 3 | 20 | 13.59 | +18 | 23 | 06.12 | 1.010 4304 | 15 | 49.74 | 11 | 56 | 20.72 |
| | 14 | 3 | 24 | 10.01 | 18 | 37 | 44.62 | 1.010 6497 | 15 | 49.53 | 11 | 56 | 20.85 |
| | 15 | 3 | 28 | 06.98 | 18 | 52 | 04.23 | 1.010 8646 | 15 | 49.33 | 11 | 56 | 21.54 |
| | 16 | 3 | 32 | 04.52 | 19 | 06 | 04.65 | 1.011 0753 | 15 | 49.13 | 11 | 56 | 22.79 |
| | 17 | 3 | 36 | 02.60 | +19 | 19 | 45.61 | 1.011 2819 | 15 | 48.94 | 11 | 56 | 24.59 |

**SUN, 2021**

FOR $0^h$ TERRESTRIAL TIME

| Date | | Geometric Longitude* (Mean Equinox of date ) | | | Latitude ( Ecliptic of date ) | Apparent Longitude (True equinox of date) | | | Aberra-tion | Prec. in Long. ( J 2021.5 of date ) | Nut. in Long. | Nut. in Obliquity | True Obliquity (23° 26') |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | " | ° | ' | " | " | " | " | " | " |
| May | 17 | 56 | 20 | 00.78 | +0.79 | 56 | 19 | 23.34 | 20.27 | -6.45 | -17.22 | +2.66 | 14.05 |
| | 18 | 57 | 17 | 49.80 | 0.86 | 57 | 17 | 12.44 | 20.26 | 6.31 | 17.14 | 2.68 | 14.08 |
| | 19 | 58 | 15 | 37.13 | 0.90 | 58 | 14 | 59.82 | 20.26 | 6.17 | 17.09 | 2.72 | 14.11 |
| | 20 | 59 | 13 | 22.81 | 0.94 | 59 | 12 | 45.50 | 20.25 | 6.03 | 17.09 | 2.76 | 14.15 |
| | 21 | 60 | 11 | 06.84 | 0.94 | 60 | 10 | 29.50 | 20.25 | 5.89 | 17.14 | 2.79 | 14.18 |
| | 22 | 61 | 08 | 49.21 | 0.90 | 61 | 08 | 11.80 | 20.25 | 5.75 | 17.21 | 2.80 | 14.19 |
| | 23 | 62 | 06 | 29.97 | +0.83 | 62 | 05 | 52.48 | 20.24 | -5.61 | -17.30 | +2.80 | 14.18 |
| | 24 | 63 | 04 | 09.24 | 0.72 | 63 | 03 | 31.68 | 20.24 | 5.47 | 17.37 | 2.76 | 14.15 |
| | 25 | 64 | 01 | 47.01 | 0.61 | 64 | 01 | 09.44 | 20.24 | 5.33 | 17.38 | 2.70 | 14.09 |
| | 26 | 64 | 59 | 23.45 | 0.47 | 64 | 58 | 45.95 | 20.23 | 5.19 | 17.31 | 2.64 | 14.02 |
| | 27 | 65 | 56 | 58.59 | 0.32 | 65 | 56 | 21.23 | 20.23 | 5.06 | 17.18 | 2.58 | 13.96 |
| | 28 | 66 | 54 | 32.64 | 0.18 | 66 | 53 | 55.46 | 20.23 | 4.92 | 17.00 | 2.55 | 13.93 |
| | 29 | 67 | 52 | 05.61 | +0.04 | 67 | 51 | 28.62 | 20.22 | -4.78 | -16.81 | +2.55 | 13.93 |
| | 30 | 68 | 49 | 37.67 | -0.07 | 68 | 49 | 00.84 | 20.22 | 4.64 | 16.65 | 2.57 | 13.95 |
| | 31 | 69 | 47 | 08.84 | 0.14 | 69 | 46 | 32.12 | 20.22 | 4.50 | 16.55 | 2.61 | 13.99 |
| Jun | 1 | 70 | 44 | 39.22 | 0.22 | 70 | 44 | 02.54 | 20.21 | 4.36 | 16.50 | 2.66 | 14.04 |
| | 2 | 71 | 42 | 08.78 | 0.25 | 71 | 41 | 32.10 | 20.21 | 4.22 | 16.52 | 2.70 | 14.08 |
| | 3 | 72 | 39 | 37.66 | 0.25 | 72 | 39 | 00.94 | 20.21 | 4.08 | 16.57 | 2.73 | 14.10 |
| | 4 | 73 | 37 | 05.77 | -0.22 | 73 | 36 | 28.98 | 20.20 | -3.94 | -16.63 | +2.74 | 14.11 |
| | 5 | 74 | 34 | 33.20 | 0.18 | 74 | 33 | 56.34 | 20.20 | 3.80 | 16.71 | 2.73 | 14.10 |
| | 6 | 75 | 31 | 59.93 | -0.07 | 75 | 31 | 23.02 | 20.20 | 3.67 | 16.76 | 2.71 | 14.08 |
| | 7 | 76 | 29 | 25.91 | 0.00 | 76 | 28 | 48.97 | 20.19 | 3.53 | 16.79 | 2.67 | 14.04 |
| | 8 | 77 | 26 | 51.20 | +0.11 | 77 | 26 | 14.28 | 20.19 | 3.39 | 16.77 | 2.63 | 14.00 |
| | 9 | 78 | 24 | 15.74 | 0.25 | 78 | 23 | 38.87 | 20.19 | 3.25 | 16.72 | 2.59 | 13.95 |
| | 10 | 79 | 21 | 39.55 | +0.36 | 79 | 21 | 02.77 | 20.19 | -3.11 | -16.64 | +2.55 | 13.92 |
| | 11 | 80 | 19 | 02.58 | 0.50 | 80 | 18 | 25.92 | 20.19 | 2.97 | 16.52 | 2.53 | 13.90 |
| | 12 | 81 | 16 | 24.81 | 0.61 | 81 | 15 | 48.28 | 20.18 | 2.83 | 16.39 | 2.53 | 13.89 |
| | 13 | 82 | 13 | 46.28 | 0.72 | 82 | 13 | 09.88 | 20.18 | 2.69 | 16.27 | 2.55 | 13.91 |
| | 14 | 83 | 11 | 06.87 | 0.79 | 83 | 10 | 30.58 | 20.18 | 2.55 | 16.16 | 2.58 | 13.94 |
| | 15 | 84 | 08 | 26.67 | 0.86 | 84 | 07 | 50.45 | 20.18 | 2.42 | 16.09 | 2.62 | 13.98 |
| | 16 | 85 | 05 | 45.61 | +0.90 | 85 | 05 | 09.42 | 20.18 | -2.28 | -16.05 | +2.67 | 14.03 |
| | 17 | 86 | 03 | 03.69 | 0.90 | 86 | 02 | 27.49 | 20.17 | 2.14 | 16.07 | 2.72 | 14.08 |
| | 18 | 87 | 00 | 20.91 | 0.86 | 86 | 59 | 44.66 | 20.17 | 2.00 | 16.12 | 2.76 | 14.11 |
| | 19 | 87 | 57 | 37.28 | 0.79 | 87 | 57 | 00.97 | 20.17 | 1.86 | 16.18 | 2.77 | 14.12 |
| | 20 | 88 | 54 | 52.82 | 0.72 | 88 | 54 | 16.45 | 20.17 | 1.72 | 16.24 | 2.76 | 14.11 |
| | 21 | 89 | 52 | 07.64 | 0.61 | 89 | 51 | 31.25 | 20.17 | 1.58 | 16.26 | 2.73 | 14.08 |
| | 22 | 90 | 49 | 21.70 | +0.47 | 90 | 48 | 45.36 | 20.17 | -1.44 | -16.22 | +2.68 | 14.03 |
| | 23 | 91 | 46 | 35.19 | 0.32 | 91 | 45 | 58.97 | 20.17 | 1.30 | 16.11 | 2.63 | 13.98 |
| | 24 | 92 | 43 | 48.12 | 0.18 | 92 | 43 | 12.07 | 20.16 | 1.16 | 15.93 | 2.60 | 13.95 |
| | 25 | 93 | 41 | 00.63 | +0.04 | 93 | 40 | 24.78 | 20.16 | 1.03 | 15.73 | 2.60 | 13.95 |
| | 26 | 94 | 38 | 12.86 | -0.07 | 94 | 37 | 37.20 | 20.16 | 0.89 | 15.54 | 2.63 | 13.98 |
| | 27 | 95 | 35 | 24.88 | 0.18 | 95 | 34 | 49.37 | 20.16 | 0.75 | 15.39 | 2.69 | 14.03 |
| | 28 | 96 | 32 | 36.82 | -0.25 | 96 | 32 | 01.39 | 20.16 | -0.61 | -15.31 | +2.75 | 14.09 |
| | 29 | 97 | 29 | 48.72 | 0.29 | 97 | 29 | 13.31 | 20.16 | 0.47 | 15.30 | 2.82 | 14.16 |
| | 30 | 98 | 27 | 00.67 | 0.32 | 98 | 26 | 25.22 | 20.16 | 0.33 | 15.33 | 2.87 | 14.21 |
| Jul | 1 | 99 | 24 | 12.75 | 0.29 | 99 | 23 | 37.25 | 20.16 | 0.19 | 15.39 | 2.90 | 14.24 |
| | 2 | 100 | 21 | 24.95 | -0.25 | 100 | 20 | 49.38 | 20.16 | -0.05 | -15.46 | +2.91 | 14.25 |

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -18' 01".251 and subtract precession from J 2021.5.

**SUN, 2021**

FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Semi Diameter | | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | ' | " | h | m | s |
| May | 17 | 3 | 36 | 02.60 | +19 | 19 | 45.61 | 1.011 2819 | 15 | 48.94 | 11 | 56 | 24.59 |
| | 18 | 3 | 40 | 01.23 | 19 | 33 | 06.80 | 1.011 4844 | 15 | 48.75 | 11 | 56 | 26.92 |
| | 19 | 3 | 44 | 00.39 | 19 | 46 | 07.96 | 1.011 6831 | 15 | 48.56 | 11 | 56 | 29.79 |
| | 20 | 3 | 48 | 00.07 | 19 | 58 | 48.82 | 1.011 8781 | 15 | 48.38 | 11 | 56 | 33.18 |
| | 21 | 3 | 52 | 00.28 | 20 | 11 | 09.10 | 1.012 0696 | 15 | 48.20 | 11 | 56 | 37.08 |
| | 22 | 3 | 56 | 00.99 | 20 | 23 | 08.56 | 1.012 2580 | 15 | 48.02 | 11 | 56 | 41.49 |
| | 23 | 4 | 00 | 02.21 | +20 | 34 | 46.95 | 1.012 4435 | 15 | 47.85 | 11 | 56 | 46.41 |
| | 24 | 4 | 04 | 03.92 | 20 | 46 | 04.07 | 1.012 6264 | 15 | 47.68 | 11 | 56 | 51.82 |
| | 25 | 4 | 08 | 06.13 | 20 | 56 | 59.69 | 1.012 8069 | 15 | 47.51 | 11 | 56 | 57.72 |
| | 26 | 4 | 12 | 08.84 | 21 | 07 | 33.64 | 1.012 9852 | 15 | 47.34 | 11 | 57 | 04.10 |
| | 27 | 4 | 16 | 12.02 | 21 | 17 | 45.73 | 1.013 1613 | 15 | 47.18 | 11 | 57 | 10.96 |
| | 28 | 4 | 20 | 15.68 | 21 | 27 | 35.78 | 1.013 3352 | 15 | 47.02 | 11 | 57 | 18.29 |
| | 29 | 4 | 24 | 19.81 | +21 | 37 | 03.60 | 1.013 5067 | 15 | 46.86 | 11 | 57 | 26.08 |
| | 30 | 4 | 28 | 24.39 | 21 | 46 | 09.00 | 1.013 6755 | 15 | 46.70 | 11 | 57 | 34.32 |
| | 31 | 4 | 32 | 29.41 | 21 | 54 | 51.79 | 1.013 8414 | 15 | 46.54 | 11 | 57 | 42.99 |
| Jun | 1 | 4 | 36 | 34.86 | 22 | 03 | 11.76 | 1.014 0039 | 15 | 46.39 | 11 | 57 | 52.09 |
| | 2 | 4 | 40 | 40.72 | 22 | 11 | 08.73 | 1.014 1627 | 15 | 46.24 | 11 | 58 | 01.60 |
| | 3 | 4 | 44 | 46.97 | 22 | 18 | 42.53 | 1.014 3175 | 15 | 46.10 | 11 | 58 | 11.50 |
| | 4 | 4 | 48 | 53.61 | +22 | 25 | 52.97 | 1.014 4679 | 15 | 45.96 | 11 | 58 | 21.77 |
| | 5 | 4 | 53 | 00.61 | 22 | 32 | 39.89 | 1.014 6138 | 15 | 45.82 | 11 | 58 | 32.39 |
| | 6 | 4 | 57 | 07.95 | 22 | 39 | 03.15 | 1.014 7547 | 15 | 45.69 | 11 | 58 | 43.34 |
| | 7 | 5 | 01 | 15.61 | 22 | 45 | 02.59 | 1.014 8906 | 15 | 45.56 | 11 | 58 | 54.61 |
| | 8 | 5 | 05 | 23.58 | 22 | 50 | 38.08 | 1.015 0211 | 15 | 45.44 | 11 | 59 | 06.16 |
| | 9 | 5 | 09 | 31.82 | 22 | 55 | 49.49 | 1.015 1463 | 15 | 45.33 | 11 | 59 | 17.97 |
| | 10 | 5 | 13 | 40.32 | +23 | 00 | 36.70 | 1.015 2659 | 15 | 45.22 | 11 | 59 | 30.03 |
| | 11 | 5 | 17 | 49.05 | 23 | 04 | 59.61 | 1.015 3798 | 15 | 45.11 | 11 | 59 | 42.30 |
| | 12 | 5 | 21 | 57.97 | 23 | 08 | 58.12 | 1.015 4881 | 15 | 45.01 | 11 | 59 | 54.75 |
| | 13 | 5 | 26 | 07.08 | 23 | 12 | 32.12 | 1.015 5907 | 15 | 44.91 | 12 | 00 | 07.37 |
| | 14 | 5 | 30 | 16.33 | 23 | 15 | 41.54 | 1.015 6876 | 15 | 44.82 | 12 | 00 | 20.13 |
| | 15 | 5 | 34 | 25.70 | 23 | 18 | 26.31 | 1.015 7791 | 15 | 44.74 | 12 | 00 | 32.99 |
| | 16 | 5 | 38 | 35.16 | +23 | 20 | 46.36 | 1.015 8651 | 15 | 44.66 | 12 | 00 | 45.94 |
| | 17 | 5 | 42 | 44.70 | 23 | 22 | 41.64 | 1.015 9460 | 15 | 44.58 | 12 | 00 | 58.95 |
| | 18 | 5 | 46 | 54.27 | 23 | 24 | 12.10 | 1.016 0220 | 15 | 44.51 | 12 | 01 | 11.99 |
| | 19 | 5 | 51 | 03.87 | 23 | 25 | 17.72 | 1.016 0932 | 15 | 44.45 | 12 | 01 | 25.04 |
| | 20 | 5 | 55 | 13.46 | 23 | 25 | 58.49 | 1.016 1602 | 15 | 44.38 | 12 | 01 | 38.07 |
| | 21 | 5 | 59 | 23.03 | 23 | 26 | 14.41 | 1.016 2230 | 15 | 44.32 | 12 | 01 | 51.07 |
| | 22 | 6 | 03 | 32.56 | +23 | 26 | 05.51 | 1.016 2822 | 15 | 44.27 | 12 | 02 | 04.01 |
| | 23 | 6 | 07 | 42.02 | 23 | 25 | 31.82 | 1.016 3380 | 15 | 44.22 | 12 | 02 | 16.87 |
| | 24 | 6 | 11 | 51.41 | 23 | 24 | 33.40 | 1.016 3905 | 15 | 44.17 | 12 | 02 | 29.64 |
| | 25 | 6 | 16 | 00.69 | 23 | 23 | 10.30 | 1.016 4399 | 15 | 44.12 | 12 | 02 | 42.29 |
| | 26 | 6 | 20 | 09.84 | 23 | 21 | 22.58 | 1.016 4862 | 15 | 44.08 | 12 | 02 | 54.82 |
| | 27 | 6 | 24 | 18.86 | 23 | 19 | 10.27 | 1.016 5292 | 15 | 44.04 | 12 | 03 | 07.19 |
| | 28 | 6 | 28 | 27.71 | +23 | 16 | 33.43 | 1.016 5688 | 15 | 44.00 | 12 | 03 | 19.40 |
| | 29 | 6 | 32 | 36.38 | 23 | 13 | 32.12 | 1.016 6047 | 15 | 43.97 | 12 | 03 | 31.42 |
| | 30 | 6 | 36 | 44.86 | 23 | 10 | 06.41 | 1.016 6366 | 15 | 43.94 | 12 | 03 | 43.24 |
| Jul | 1 | 6 | 40 | 53.11 | 23 | 06 | 16.36 | 1.016 6642 | 15 | 43.92 | 12 | 03 | 54.82 |
| | 2 | 6 | 45 | 01.12 | +23 | 02 | 02.07 | 1.016 6873 | 15 | 43.89 | 12 | 04 | 06.16 |

**SUN, 2021**

FOR $0^h$ TERRESTRIAL TIME

| Date | | Geometric Longitude* (Mean Equinox of date ) | | | Latitude ( Ecliptic of date ) | Apparent Longitude (True equinox of date) | | | Aberra- tion | Prec. in Long. ( J 2021.5 of date ) | Nut. in Long. | Nut. in Obliquity | True Obliquity (23° 26') |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | " | ° | ' | " | " | " | " | " | " |
| Jul | 1 | 99 | 24 | 12.75 | -0.29 | 99 | 23 | 37.25 | 20.16 | -0.19 | -15.39 | +2.90 | 14.24 |
| | 2 | 100 | 21 | 24.95 | 0.25 | 100 | 20 | 49.38 | 20.16 | -0.05 | 15.46 | 2.91 | 14.25 |
| | 3 | 101 | 18 | 37.32 | 0.18 | 101 | 18 | 01.69 | 20.16 | +0.09 | 15.52 | 2.91 | 14.24 |
| | 4 | 102 | 15 | 49.92 | -0.11 | 102 | 15 | 14.26 | 20.16 | 0.23 | 15.55 | 2.89 | 14.22 |
| | 5 | 103 | 13 | 02.70 | 0.00 | 103 | 12 | 27.04 | 20.16 | 0.36 | 15.55 | 2.87 | 14.20 |
| | 6 | 104 | 10 | 15.69 | +0.14 | 104 | 09 | 40.07 | 20.16 | 0.50 | 15.51 | 2.84 | 14.17 |
| | 7 | 105 | 07 | 28.90 | +0.25 | 105 | 06 | 53.35 | 20.16 | +0.64 | -15.43 | +2.82 | 14.15 |
| | 8 | 106 | 04 | 42.33 | 0.36 | 106 | 04 | 06.89 | 20.16 | 0.78 | 15.33 | 2.81 | 14.14 |
| | 9 | 107 | 01 | 55.96 | 0.47 | 107 | 01 | 20.64 | 20.16 | 0.92 | 15.20 | 2.82 | 14.15 |
| | 10 | 107 | 59 | 09.77 | 0.58 | 107 | 58 | 34.57 | 20.16 | 1.06 | 15.08 | 2.85 | 14.17 |
| | 11 | 108 | 56 | 23.77 | 0.68 | 108 | 55 | 48.68 | 20.16 | 1.20 | 14.97 | 2.89 | 14.22 |
| | 12 | 109 | 53 | 37.88 | 0.76 | 109 | 53 | 02.87 | 20.16 | 1.34 | 14.90 | 2.95 | 14.27 |
| | 13 | 110 | 50 | 52.14 | +0.79 | 110 | 50 | 17.16 | 20.16 | +1.48 | -14.86 | +3.02 | 14.34 |
| | 14 | 111 | 48 | 06.48 | 0.79 | 111 | 47 | 31.49 | 20.16 | 1.62 | 14.88 | 3.08 | 14.40 |
| | 15 | 112 | 45 | 20.90 | 0.76 | 112 | 44 | 45.85 | 20.16 | 1.75 | 14.93 | 3.14 | 14.45 |
| | 16 | 113 | 42 | 35.42 | 0.72 | 113 | 42 | 00.29 | 20.16 | 1.89 | 15.01 | 3.17 | 14.49 |
| | 17 | 114 | 39 | 49.97 | 0.65 | 114 | 39 | 14.76 | 20.17 | 2.03 | 15.09 | 3.18 | 14.50 |
| | 18 | 115 | 37 | 04.64 | 0.54 | 115 | 36 | 29.38 | 20.17 | 2.17 | 15.14 | 3.17 | 14.48 |
| | 19 | 116 | 34 | 19.40 | +0.40 | 116 | 33 | 44.14 | 20.17 | +2.31 | -15.14 | +3.14 | 14.45 |
| | 20 | 117 | 31 | 34.27 | 0.25 | 117 | 30 | 59.08 | 20.17 | 2.45 | 15.07 | 3.11 | 14.42 |
| | 21 | 118 | 28 | 49.41 | +0.11 | 118 | 28 | 14.34 | 20.17 | 2.59 | 14.94 | 3.08 | 14.40 |
| | 22 | 119 | 26 | 04.83 | 0.00 | 119 | 25 | 29.93 | 20.17 | 2.73 | 14.77 | 3.09 | 14.40 |
| | 23 | 120 | 23 | 20.60 | -0.14 | 120 | 22 | 45.88 | 20.17 | 2.87 | 14.60 | 3.12 | 14.43 |
| | 24 | 121 | 20 | 36.92 | 0.25 | 121 | 20 | 02.33 | 20.18 | 3.01 | 14.46 | 3.18 | 14.49 |
| | 25 | 122 | 17 | 53.79 | -0.32 | 122 | 17 | 19.28 | 20.18 | +3.14 | -14.37 | +3.25 | 14.56 |
| | 26 | 123 | 15 | 11.38 | 0.40 | 123 | 14 | 36.89 | 20.18 | 3.28 | 14.35 | 3.33 | 14.64 |
| | 27 | 124 | 12 | 29.78 | 0.40 | 124 | 11 | 55.25 | 20.18 | 3.42 | 14.39 | 3.40 | 14.71 |
| | 28 | 125 | 09 | 49.04 | 0.40 | 125 | 09 | 14.44 | 20.18 | 3.56 | 14.47 | 3.45 | 14.76 |
| | 29 | 126 | 07 | 09.23 | 0.36 | 126 | 06 | 34.52 | 20.19 | 3.70 | 14.56 | 3.49 | 14.79 |
| | 30 | 127 | 04 | 30.45 | 0.29 | 127 | 03 | 55.66 | 20.19 | 3.84 | 14.65 | 3.50 | 14.80 |
| | 31 | 128 | 01 | 52.70 | -0.22 | 128 | 01 | 17.83 | 20.19 | +3.98 | -14.72 | +3.49 | 14.79 |
| Aug | 1 | 128 | 59 | 16.03 | -0.11 | 128 | 58 | 41.12 | 20.19 | 4.12 | 14.76 | 3.48 | 14.78 |
| | 2 | 129 | 56 | 40.44 | 0.00 | 129 | 56 | 05.53 | 20.20 | 4.26 | 14.76 | 3.46 | 14.76 |
| | 3 | 130 | 54 | 06.04 | +0.11 | 130 | 53 | 31.16 | 20.20 | 4.40 | 14.73 | 3.45 | 14.75 |
| | 4 | 131 | 51 | 32.73 | 0.22 | 131 | 50 | 57.91 | 20.20 | 4.53 | 14.66 | 3.45 | 14.74 |
| | 5 | 132 | 49 | 00.58 | 0.32 | 132 | 48 | 25.85 | 20.20 | 4.67 | 14.57 | 3.46 | 14.75 |
| | 6 | 133 | 46 | 29.57 | +0.43 | 133 | 45 | 54.94 | 20.21 | +4.81 | -14.48 | +3.49 | 14.78 |
| | 7 | 134 | 43 | 59.73 | 0.54 | 134 | 43 | 25.18 | 20.21 | 4.95 | 14.39 | 3.53 | 14.82 |
| | 8 | 135 | 41 | 30.96 | 0.58 | 135 | 40 | 56.46 | 20.21 | 5.09 | 14.34 | 3.60 | 14.89 |
| | 9 | 136 | 39 | 03.28 | 0.65 | 136 | 38 | 28.79 | 20.21 | 5.23 | 14.32 | 3.67 | 14.96 |
| | 10 | 137 | 36 | 36.66 | 0.65 | 137 | 36 | 02.12 | 20.22 | 5.37 | 14.36 | 3.74 | 15.03 |
| | 11 | 138 | 34 | 11.05 | 0.61 | 138 | 33 | 36.43 | 20.22 | 5.51 | 14.44 | 3.81 | 15.09 |
| | 12 | 139 | 31 | 46.44 | +0.58 | 139 | 31 | 11.71 | 20.22 | +5.65 | -14.55 | +3.85 | 15.14 |
| | 13 | 140 | 29 | 22.78 | 0.50 | 140 | 28 | 47.93 | 20.23 | 5.79 | 14.67 | 3.87 | 15.15 |
| | 14 | 141 | 27 | 00.03 | 0.40 | 141 | 26 | 25.08 | 20.23 | 5.93 | 14.76 | 3.87 | 15.15 |
| | 15 | 142 | 24 | 38.24 | 0.29 | 142 | 24 | 03.24 | 20.24 | 6.06 | 14.81 | 3.84 | 15.12 |
| | 16 | 143 | 22 | 17.36 | +0.14 | 143 | 21 | 42.37 | 20.24 | +6.20 | -14.79 | +3.82 | 15.09 |

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -18' 01".251 and subtract precession from J 2021.5.

**SUN, 2021**

FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Semi Diameter | | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | ' | " | h | m | s |
| Jul | 1 | 6 | 40 | 53.11 | +23 | 06 | 16.36 | 1.016 6642 | 15 | 43.92 | 12 | 03 | 54.82 |
| | 2 | 6 | 45 | 01.12 | 23 | 02 | 02.07 | 1.016 6873 | 15 | 43.89 | 12 | 04 | 06.16 |
| | 3 | 6 | 49 | 08.88 | 22 | 57 | 23.64 | 1.016 7056 | 15 | 43.88 | 12 | 04 | 17.22 |
| | 4 | 6 | 53 | 16.35 | 22 | 52 | 21.18 | 1.016 7188 | 15 | 43.86 | 12 | 04 | 28.00 |
| | 5 | 6 | 57 | 23.53 | 22 | 46 | 54.81 | 1.016 7268 | 15 | 43.86 | 12 | 04 | 38.46 |
| | 6 | 7 | 01 | 30.38 | 22 | 41 | 04.66 | 1.016 7292 | 15 | 43.85 | 12 | 04 | 48.58 |
| | 7 | 7 | 05 | 36.89 | +22 | 34 | 50.88 | 1.016 7260 | 15 | 43.86 | 12 | 04 | 58.35 |
| | 8 | 7 | 09 | 43.04 | 22 | 28 | 13.61 | 1.016 7170 | 15 | 43.87 | 12 | 05 | 07.74 |
| | 9 | 7 | 13 | 48.79 | 22 | 21 | 13.02 | 1.016 7020 | 15 | 43.88 | 12 | 05 | 16.73 |
| | 10 | 7 | 17 | 54.14 | 22 | 13 | 49.28 | 1.016 6810 | 15 | 43.90 | 12 | 05 | 25.30 |
| | 11 | 7 | 21 | 59.05 | 22 | 06 | 02.56 | 1.016 6539 | 15 | 43.92 | 12 | 05 | 33.43 |
| | 12 | 7 | 26 | 03.52 | 21 | 57 | 53.06 | 1.016 6208 | 15 | 43.96 | 12 | 05 | 41.10 |
| | 13 | 7 | 30 | 07.51 | +21 | 49 | 20.95 | 1.016 5817 | 15 | 43.99 | 12 | 05 | 48.29 |
| | 14 | 7 | 34 | 11.00 | 21 | 40 | 26.44 | 1.016 5367 | 15 | 44.03 | 12 | 05 | 54.98 |
| | 15 | 7 | 38 | 13.99 | 21 | 31 | 09.73 | 1.016 4860 | 15 | 44.08 | 12 | 06 | 01.16 |
| | 16 | 7 | 42 | 16.46 | 21 | 21 | 31.03 | 1.016 4299 | 15 | 44.13 | 12 | 06 | 06.80 |
| | 17 | 7 | 46 | 18.39 | 21 | 11 | 30.57 | 1.016 3686 | 15 | 44.19 | 12 | 06 | 11.91 |
| | 18 | 7 | 50 | 19.77 | 21 | 01 | 08.58 | 1.016 3025 | 15 | 44.25 | 12 | 06 | 16.45 |
| | 19 | 7 | 54 | 20.59 | +20 | 50 | 25.29 | 1.016 2319 | 15 | 44.32 | 12 | 06 | 20.43 |
| | 20 | 7 | 58 | 20.84 | 20 | 39 | 20.96 | 1.016 1572 | 15 | 44.39 | 12 | 06 | 23.84 |
| | 21 | 8 | 02 | 20.53 | 20 | 27 | 55.85 | 1.016 0787 | 15 | 44.46 | 12 | 06 | 26.67 |
| | 22 | 8 | 06 | 19.63 | 20 | 16 | 10.22 | 1.015 9968 | 15 | 44.54 | 12 | 06 | 28.91 |
| | 23 | 8 | 10 | 18.15 | 20 | 04 | 04.32 | 1.015 9117 | 15 | 44.61 | 12 | 06 | 30.57 |
| | 24 | 8 | 14 | 16.09 | 19 | 51 | 38.42 | 1.015 8235 | 15 | 44.70 | 12 | 06 | 31.64 |
| | 25 | 8 | 18 | 13.43 | +19 | 38 | 52.75 | 1.015 7323 | 15 | 44.78 | 12 | 06 | 32.13 |
| | 26 | 8 | 22 | 10.18 | 19 | 25 | 47.55 | 1.015 6380 | 15 | 44.87 | 12 | 06 | 32.02 |
| | 27 | 8 | 26 | 06.33 | 19 | 12 | 23.08 | 1.015 5406 | 15 | 44.96 | 12 | 06 | 31.33 |
| | 28 | 8 | 30 | 01.90 | 18 | 58 | 39.57 | 1.015 4398 | 15 | 45.05 | 12 | 06 | 30.05 |
| | 29 | 8 | 33 | 56.88 | 18 | 44 | 37.28 | 1.015 3354 | 15 | 45.15 | 12 | 06 | 28.18 |
| | 30 | 8 | 37 | 51.27 | 18 | 30 | 16.46 | 1.015 2273 | 15 | 45.25 | 12 | 06 | 25.72 |
| | 31 | 8 | 41 | 45.07 | +18 | 15 | 37.39 | 1.015 1151 | 15 | 45.36 | 12 | 06 | 22.67 |
| Aug | 1 | 8 | 45 | 38.28 | 18 | 00 | 40.35 | 1.014 9988 | 15 | 45.46 | 12 | 06 | 19.03 |
| | 2 | 8 | 49 | 30.90 | 17 | 45 | 25.61 | 1.014 8780 | 15 | 45.58 | 12 | 06 | 14.81 |
| | 3 | 8 | 53 | 22.94 | 17 | 29 | 53.47 | 1.014 7526 | 15 | 45.69 | 12 | 06 | 09.99 |
| | 4 | 8 | 57 | 14.39 | 17 | 14 | 04.22 | 1.014 6224 | 15 | 45.81 | 12 | 06 | 04.58 |
| | 5 | 9 | 01 | 05.25 | 16 | 57 | 58.15 | 1.014 4872 | 15 | 45.94 | 12 | 05 | 58.59 |
| | 6 | 9 | 04 | 55.53 | +16 | 41 | 35.58 | 1.014 3469 | 15 | 46.07 | 12 | 05 | 52.01 |
| | 7 | 9 | 08 | 45.21 | 16 | 24 | 56.81 | 1.014 2013 | 15 | 46.21 | 12 | 05 | 44.84 |
| | 8 | 9 | 12 | 34.31 | 16 | 08 | 02.15 | 1.014 0504 | 15 | 46.35 | 12 | 05 | 37.08 |
| | 9 | 9 | 16 | 22.82 | 15 | 50 | 51.92 | 1.013 8941 | 15 | 46.49 | 12 | 05 | 28.75 |
| | 10 | 9 | 20 | 10.75 | 15 | 33 | 26.44 | 1.013 7325 | 15 | 46.64 | 12 | 05 | 19.83 |
| | 11 | 9 | 23 | 58.09 | 15 | 15 | 46.02 | 1.013 5655 | 15 | 46.80 | 12 | 05 | 10.33 |
| | 12 | 9 | 27 | 44.85 | +14 | 57 | 50.98 | 1.013 3934 | 15 | 46.96 | 12 | 05 | 00.25 |
| | 13 | 9 | 31 | 31.04 | 14 | 39 | 41.64 | 1.013 2163 | 15 | 47.13 | 12 | 04 | 49.61 |
| | 14 | 9 | 35 | 16.66 | 14 | 21 | 18.33 | 1.013 0346 | 15 | 47.30 | 12 | 04 | 38.40 |
| | 15 | 9 | 39 | 01.73 | 14 | 02 | 41.38 | 1.012 8485 | 15 | 47.47 | 12 | 04 | 26.63 |
| | 16 | 9 | 42 | 46.24 | +13 | 43 | 51.11 | 1.012 6585 | 15 | 47.65 | 12 | 04 | 14.32 |

**SUN, 2021**

FOR $0^h$ TERRESTRIAL TIME

| Date | | Geometric Longitude* (Mean Equinox of date ) | | | Latitude ( Ecliptic of date ) | Apparent Longitude (True equinox of date) | | | Aberra-tion | Prec. in Long. ( J 2021.5 of date ) | Nut. in Long. | Nut. in Obliquity | True Obliquity (23° 26') |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | " | ° | ' | " | " | " | " | " | " |
| Aug | 16 | 143 | 22 | 17.36 | +0.14 | 143 | 21 | 42.37 | 20.24 | +6.20 | -14.79 | +3.82 | 15.09 |
| | 17 | 144 | 19 | 57.43 | 0.00 | 144 | 19 | 22.51 | 20.24 | 6.34 | 14.72 | 3.79 | 15.07 |
| | 18 | 145 | 17 | 38.50 | -0.11 | 145 | 17 | 03.70 | 20.25 | 6.48 | 14.61 | 3.79 | 15.07 |
| | 19 | 146 | 15 | 20.61 | 0.25 | 146 | 14 | 45.92 | 20.25 | 6.62 | 14.48 | 3.82 | 15.09 |
| | 20 | 147 | 13 | 03.81 | 0.36 | 147 | 12 | 29.23 | 20.26 | 6.76 | 14.37 | 3.87 | 15.14 |
| | 21 | 148 | 10 | 48.24 | 0.43 | 148 | 10 | 13.73 | 20.26 | 6.90 | 14.30 | 3.94 | 15.21 |
| | 22 | 149 | 08 | 33.93 | -0.50 | 149 | 07 | 59.41 | 20.26 | +7.04 | -14.30 | +4.01 | 15.28 |
| | 23 | 150 | 06 | 21.01 | 0.54 | 150 | 05 | 46.43 | 20.27 | 7.18 | 14.36 | 4.09 | 15.36 |
| | 24 | 151 | 04 | 09.57 | 0.50 | 151 | 03 | 34.88 | 20.27 | 7.32 | 14.46 | 4.14 | 15.41 |
| | 25 | 152 | 01 | 59.67 | 0.50 | 152 | 01 | 24.85 | 20.28 | 7.45 | 14.59 | 4.18 | 15.45 |
| | 26 | 152 | 59 | 51.43 | 0.43 | 152 | 59 | 16.48 | 20.28 | 7.59 | 14.72 | 4.20 | 15.46 |
| | 27 | 153 | 57 | 44.83 | 0.36 | 153 | 57 | 09.76 | 20.28 | 7.73 | 14.83 | 4.20 | 15.46 |
| | 28 | 154 | 55 | 40.00 | -0.25 | 154 | 55 | 04.84 | 20.29 | +7.87 | -14.92 | +4.18 | 15.44 |
| | 29 | 155 | 53 | 36.97 | 0.14 | 155 | 53 | 01.75 | 20.29 | 8.01 | 14.97 | 4.16 | 15.42 |
| | 30 | 156 | 51 | 35.77 | -0.04 | 156 | 51 | 00.54 | 20.30 | 8.15 | 14.98 | 4.14 | 15.40 |
| | 31 | 157 | 49 | 36.41 | +0.07 | 157 | 49 | 01.20 | 20.30 | 8.29 | 14.96 | 4.13 | 15.39 |
| Sep | 1 | 158 | 47 | 38.94 | 0.18 | 158 | 47 | 03.77 | 20.31 | 8.43 | 14.91 | 4.13 | 15.38 |
| | 2 | 159 | 45 | 43.32 | 0.29 | 159 | 45 | 08.21 | 20.31 | 8.57 | 14.85 | 4.14 | 15.40 |
| | 3 | 160 | 43 | 49.62 | +0.40 | 160 | 43 | 14.56 | 20.32 | +8.71 | -14.79 | +4.18 | 15.43 |
| | 4 | 161 | 41 | 57.81 | 0.47 | 161 | 41 | 22.78 | 20.32 | 8.84 | 14.76 | 4.23 | 15.48 |
| | 5 | 162 | 40 | 07.84 | 0.50 | 162 | 39 | 32.80 | 20.33 | 8.98 | 14.76 | 4.29 | 15.55 |
| | 6 | 163 | 38 | 19.71 | 0.50 | 163 | 37 | 44.62 | 20.33 | 9.12 | 14.81 | 4.36 | 15.61 |
| | 7 | 164 | 36 | 33.37 | 0.50 | 164 | 35 | 58.16 | 20.34 | 9.26 | 14.91 | 4.42 | 15.67 |
| | 8 | 165 | 34 | 48.82 | 0.43 | 165 | 34 | 13.48 | 20.34 | 9.40 | 15.05 | 4.46 | 15.71 |
| | 9 | 166 | 33 | 05.91 | +0.36 | 166 | 32 | 30.41 | 20.35 | +9.54 | -15.20 | +4.48 | 15.73 |
| | 10 | 167 | 31 | 24.70 | 0.29 | 167 | 30 | 49.07 | 20.35 | 9.68 | 15.33 | 4.47 | 15.72 |
| | 11 | 168 | 29 | 45.04 | 0.14 | 168 | 29 | 09.31 | 20.36 | 9.82 | 15.42 | 4.44 | 15.69 |
| | 12 | 169 | 28 | 06.97 | +0.04 | 169 | 27 | 31.21 | 20.36 | 9.96 | 15.44 | 4.40 | 15.64 |
| | 13 | 170 | 26 | 30.43 | -0.11 | 170 | 25 | 54.70 | 20.37 | 10.10 | 15.41 | 4.36 | 15.61 |
| | 14 | 171 | 24 | 55.42 | 0.25 | 171 | 24 | 19.76 | 20.37 | 10.23 | 15.33 | 4.34 | 15.59 |
| | 15 | 172 | 23 | 21.94 | -0.40 | 172 | 22 | 46.38 | 20.38 | +10.37 | -15.23 | +4.35 | 15.59 |
| | 16 | 173 | 21 | 50.06 | 0.50 | 173 | 21 | 14.58 | 20.38 | 10.51 | 15.14 | 4.38 | 15.62 |
| | 17 | 174 | 20 | 19.76 | 0.58 | 174 | 19 | 44.33 | 20.39 | 10.65 | 15.09 | 4.43 | 15.67 |
| | 18 | 175 | 18 | 51.10 | 0.65 | 175 | 18 | 15.66 | 20.40 | 10.79 | 15.09 | 4.49 | 15.73 |
| | 19 | 176 | 17 | 24.19 | 0.68 | 176 | 16 | 48.68 | 20.40 | 10.93 | 15.15 | 4.55 | 15.79 |
| | 20 | 177 | 15 | 59.10 | 0.68 | 177 | 15 | 23.47 | 20.41 | 11.07 | 15.27 | 4.60 | 15.84 |
| | 21 | 178 | 14 | 35.87 | -0.65 | 178 | 14 | 00.10 | 20.41 | +11.21 | -15.41 | +4.63 | 15.86 |
| | 22 | 179 | 13 | 14.60 | 0.58 | 179 | 12 | 38.66 | 20.42 | 11.35 | 15.56 | 4.64 | 15.87 |
| | 23 | 180 | 11 | 55.33 | 0.50 | 180 | 11 | 19.25 | 20.42 | 11.49 | 15.70 | 4.63 | 15.86 |
| | 24 | 181 | 10 | 38.12 | 0.40 | 181 | 10 | 01.92 | 20.43 | 11.62 | 15.81 | 4.60 | 15.83 |
| | 25 | 182 | 09 | 23.03 | 0.29 | 182 | 08 | 46.75 | 20.44 | 11.76 | 15.89 | 4.56 | 15.79 |
| | 26 | 183 | 08 | 10.10 | 0.18 | 183 | 07 | 33.78 | 20.44 | 11.90 | 15.93 | 4.53 | 15.75 |
| | 27 | 184 | 06 | 59.40 | -0.07 | 184 | 06 | 23.08 | 20.45 | +12.04 | -15.92 | +4.49 | 15.72 |
| | 28 | 185 | 05 | 50.91 | +0.04 | 185 | 05 | 14.60 | 20.45 | 12.18 | 15.89 | 4.47 | 15.70 |
| | 29 | 186 | 04 | 44.70 | 0.14 | 186 | 04 | 08.44 | 20.46 | 12.32 | 15.85 | 4.47 | 15.69 |
| | 30 | 187 | 03 | 40.76 | 0.25 | 187 | 03 | 04.54 | 20.46 | 12.46 | 15.80 | 4.48 | 15.70 |
| Oct | 1 | 188 | 02 | 39.10 | +0.32 | 188 | 02 | 02.90 | 20.47 | +12.60 | -15.77 | +4.51 | 15.73 |

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -18' 01".251 and subtract precession from J 2021.5.

**SUN, 2021**

FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Semi Diameter | | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | ' | " | h | m | s |
| Aug | 16 | 9 | 42 | 46.24 | +13 | 43 | 51.11 | 1.012 6585 | 15 | 47.65 | 12 | 04 | 14.32 |
| | 17 | 9 | 46 | 30.22 | 13 | 24 | 47.87 | 1.012 4649 | 15 | 47.83 | 12 | 04 | 01.47 |
| | 18 | 9 | 50 | 13.66 | 13 | 05 | 31.97 | 1.012 2682 | 15 | 48.01 | 12 | 03 | 48.09 |
| | 19 | 9 | 53 | 56.60 | 12 | 46 | 03.76 | 1.012 0687 | 15 | 48.20 | 12 | 03 | 34.21 |
| | 20 | 9 | 57 | 39.03 | 12 | 26 | 23.55 | 1.011 8668 | 15 | 48.39 | 12 | 03 | 19.83 |
| | 21 | 10 | 01 | 20.97 | 12 | 06 | 31.64 | 1.011 6626 | 15 | 48.58 | 12 | 03 | 04.98 |
| | 22 | 10 | 05 | 02.43 | +11 | 46 | 28.34 | 1.011 4565 | 15 | 48.78 | 12 | 02 | 49.66 |
| | 23 | 10 | 08 | 43.44 | 11 | 26 | 13.94 | 1.011 2484 | 15 | 48.97 | 12 | 02 | 33.90 |
| | 24 | 10 | 12 | 24.02 | 11 | 05 | 48.73 | 1.011 0385 | 15 | 49.17 | 12 | 02 | 17.72 |
| | 25 | 10 | 16 | 04.17 | 10 | 45 | 12.98 | 1.010 8266 | 15 | 49.37 | 12 | 02 | 01.13 |
| | 26 | 10 | 19 | 43.93 | 10 | 24 | 26.99 | 1.010 6127 | 15 | 49.57 | 12 | 01 | 44.15 |
| | 27 | 10 | 23 | 23.31 | 10 | 03 | 31.05 | 1.010 3966 | 15 | 49.77 | 12 | 01 | 26.79 |
| | 28 | 10 | 27 | 02.32 | +9 | 42 | 25.47 | 1.010 1783 | 15 | 49.98 | 12 | 01 | 09.08 |
| | 29 | 10 | 30 | 40.99 | 9 | 21 | 10.55 | 1.009 9575 | 15 | 50.18 | 12 | 00 | 51.04 |
| | 30 | 10 | 34 | 19.32 | 8 | 59 | 46.60 | 1.009 7341 | 15 | 50.39 | 12 | 00 | 32.66 |
| | 31 | 10 | 37 | 57.35 | 8 | 38 | 13.93 | 1.009 5078 | 15 | 50.61 | 12 | 00 | 13.98 |
| Sep | 1 | 10 | 41 | 35.08 | 8 | 16 | 32.87 | 1.009 2787 | 15 | 50.82 | 11 | 59 | 55.01 |
| | 2 | 10 | 45 | 12.52 | 7 | 54 | 43.74 | 1.009 0463 | 15 | 51.04 | 11 | 59 | 35.77 |
| | 3 | 10 | 48 | 49.70 | +7 | 32 | 46.87 | 1.008 8107 | 15 | 51.26 | 11 | 59 | 16.26 |
| | 4 | 10 | 52 | 26.62 | 7 | 10 | 42.59 | 1.008 5716 | 15 | 51.49 | 11 | 58 | 56.52 |
| | 5 | 10 | 56 | 03.31 | 6 | 48 | 31.23 | 1.008 3290 | 15 | 51.72 | 11 | 58 | 36.54 |
| | 6 | 10 | 59 | 39.77 | 6 | 26 | 13.14 | 1.008 0826 | 15 | 51.95 | 11 | 58 | 16.35 |
| | 7 | 11 | 03 | 16.03 | 6 | 03 | 48.66 | 1.007 8324 | 15 | 52.19 | 11 | 57 | 55.96 |
| | 8 | 11 | 06 | 52.08 | 5 | 41 | 18.14 | 1.007 5785 | 15 | 52.43 | 11 | 57 | 35.38 |
| | 9 | 11 | 10 | 27.96 | +5 | 18 | 41.90 | 1.007 3209 | 15 | 52.67 | 11 | 57 | 14.64 |
| | 10 | 11 | 14 | 03.68 | 4 | 56 | 00.32 | 1.007 0597 | 15 | 52.92 | 11 | 56 | 53.74 |
| | 11 | 11 | 17 | 39.25 | 4 | 33 | 13.72 | 1.006 7953 | 15 | 53.17 | 11 | 56 | 32.69 |
| | 12 | 11 | 21 | 14.69 | 4 | 10 | 22.47 | 1.006 5278 | 15 | 53.42 | 11 | 56 | 11.53 |
| | 13 | 11 | 24 | 50.02 | 3 | 47 | 26.91 | 1.006 2578 | 15 | 53.68 | 11 | 55 | 50.25 |
| | 14 | 11 | 28 | 25.26 | 3 | 24 | 27.41 | 1.005 9856 | 15 | 53.93 | 11 | 55 | 28.90 |
| | 15 | 11 | 32 | 00.42 | +3 | 01 | 24.31 | 1.005 7116 | 15 | 54.19 | 11 | 55 | 07.47 |
| | 16 | 11 | 35 | 35.52 | 2 | 38 | 17.95 | 1.005 4363 | 15 | 54.46 | 11 | 54 | 46.00 |
| | 17 | 11 | 39 | 10.59 | 2 | 15 | 08.68 | 1.005 1600 | 15 | 54.72 | 11 | 54 | 24.51 |
| | 18 | 11 | 42 | 45.64 | 1 | 51 | 56.80 | 1.004 8830 | 15 | 54.98 | 11 | 54 | 03.01 |
| | 19 | 11 | 46 | 20.71 | 1 | 28 | 42.65 | 1.004 6058 | 15 | 55.25 | 11 | 53 | 41.55 |
| | 20 | 11 | 49 | 55.80 | 1 | 05 | 26.53 | 1.004 3283 | 15 | 55.51 | 11 | 53 | 20.12 |
| | 21 | 11 | 53 | 30.95 | +0 | 42 | 08.74 | 1.004 0509 | 15 | 55.77 | 11 | 52 | 58.77 |
| | 22 | 11 | 57 | 06.19 | 0 | 18 | 49.58 | 1.003 7735 | 15 | 56.04 | 11 | 52 | 37.52 |
| | 23 | 12 | 00 | 41.53 | 0 | 04 | 30.63 | 1.003 4963 | 15 | 56.30 | 11 | 52 | 16.38 |
| | 24 | 12 | 04 | 17.01 | 0 | 27 | 51.59 | 1.003 2191 | 15 | 56.57 | 11 | 51 | 55.39 |
| | 25 | 12 | 07 | 52.64 | +0 | 51 | 12.99 | 1.002 9420 | 15 | 56.83 | 11 | 51 | 34.56 |
| | 26 | 12 | 11 | 28.45 | -1 | 14 | 34.51 | 1.002 6648 | 15 | 57.09 | 11 | 51 | 13.92 |
| | 27 | 12 | 15 | 04.47 | -1 | 37 | 55.81 | 1.002 3874 | 15 | 57.36 | 11 | 50 | 53.49 |
| | 28 | 12 | 18 | 40.70 | 2 | 01 | 16.56 | 1.002 1097 | 15 | 57.62 | 11 | 50 | 33.29 |
| | 29 | 12 | 22 | 17.18 | 2 | 24 | 36.42 | 1.001 8316 | 15 | 57.89 | 11 | 50 | 13.34 |
| | 30 | 12 | 25 | 53.92 | 2 | 47 | 55.05 | 1.001 5529 | 15 | 58.16 | 11 | 49 | 53.66 |
| Oct | 1 | 12 | 29 | 30.94 | -3 | 11 | 12.09 | 1.001 2734 | 15 | 58.42 | 11 | 49 | 34.28 |

**SUN, 2021**

FOR $0^h$ TERRESTRIAL TIME

| Date | | Geometric Longitude* (Mean Equinox of date ) | | | Latitude ( Ecliptic of date ) | Apparent Longitude (True equinox of date) | | | Aberration | Prec. in Long. ( J 2021.5 of date ) | Nut. in Long. | Nut. in Obliquity | True Obliquity (23° 26') |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | " | ° | ' | " | " | " | " | " | " |
| Oct | 1 | 188 | 02 | 39.10 | +0.32 | 188 | 02 | 02.90 | 20.47 | +12.60 | -15.77 | +4.51 | 15.73 |
| | 2 | 189 | 01 | 39.73 | 0.36 | 189 | 01 | 03.54 | 20.48 | 12.74 | 15.76 | 4.55 | 15.77 |
| | 3 | 190 | 00 | 42.61 | 0.40 | 190 | 00 | 06.37 | 20.48 | 12.88 | 15.80 | 4.60 | 15.82 |
| | 4 | 190 | 59 | 47.72 | 0.40 | 190 | 59 | 11.40 | 20.49 | 13.01 | 15.88 | 4.65 | 15.86 |
| | 5 | 191 | 58 | 55.04 | 0.32 | 191 | 58 | 18.59 | 20.49 | 13.15 | 16.01 | 4.68 | 15.90 |
| | 6 | 192 | 58 | 04.51 | 0.25 | 192 | 57 | 27.90 | 20.50 | 13.29 | 16.16 | 4.69 | 15.90 |
| | 7 | 193 | 57 | 16.02 | +0.18 | 193 | 56 | 39.26 | 20.50 | +13.43 | -16.30 | +4.67 | 15.89 |
| | 8 | 194 | 56 | 29.55 | +0.04 | 194 | 55 | 52.68 | 20.51 | 13.57 | 16.40 | 4.63 | 15.84 |
| | 9 | 195 | 55 | 45.02 | -0.11 | 195 | 55 | 08.11 | 20.52 | 13.71 | 16.44 | 4.57 | 15.78 |
| | 10 | 196 | 55 | 02.30 | 0.25 | 196 | 54 | 25.42 | 20.52 | 13.85 | 16.41 | 4.51 | 15.72 |
| | 11 | 197 | 54 | 21.40 | 0.40 | 197 | 53 | 44.59 | 20.53 | 13.99 | 16.32 | 4.47 | 15.68 |
| | 12 | 198 | 53 | 42.27 | 0.50 | 198 | 53 | 05.57 | 20.53 | 14.13 | 16.21 | 4.45 | 15.66 |
| | 13 | 199 | 53 | 04.83 | -0.61 | 199 | 52 | 28.24 | 20.54 | +14.27 | -16.10 | +4.46 | 15.66 |
| | 14 | 200 | 52 | 29.13 | 0.72 | 200 | 51 | 52.60 | 20.55 | 14.41 | 16.03 | 4.49 | 15.69 |
| | 15 | 201 | 51 | 55.16 | 0.79 | 201 | 51 | 18.65 | 20.55 | 14.54 | 16.01 | 4.53 | 15.73 |
| | 16 | 202 | 51 | 22.95 | 0.83 | 202 | 50 | 46.39 | 20.56 | 14.68 | 16.05 | 4.58 | 15.78 |
| | 17 | 203 | 50 | 52.52 | 0.83 | 203 | 50 | 15.86 | 20.56 | 14.82 | 16.13 | 4.61 | 15.81 |
| | 18 | 204 | 50 | 23.92 | 0.79 | 204 | 49 | 47.14 | 20.57 | 14.96 | 16.26 | 4.63 | 15.83 |
| | 19 | 205 | 49 | 57.20 | -0.76 | 205 | 49 | 20.28 | 20.58 | +15.10 | -16.39 | +4.63 | 15.82 |
| | 20 | 206 | 49 | 32.42 | 0.65 | 206 | 48 | 55.37 | 20.58 | 15.24 | 16.52 | 4.61 | 15.80 |
| | 21 | 207 | 49 | 09.56 | 0.58 | 207 | 48 | 32.40 | 20.59 | 15.38 | 16.62 | 4.57 | 15.76 |
| | 22 | 208 | 48 | 48.76 | 0.47 | 208 | 48 | 11.52 | 20.59 | 15.52 | 16.69 | 4.52 | 15.71 |
| | 23 | 209 | 48 | 30.03 | 0.32 | 209 | 47 | 52.76 | 20.60 | 15.66 | 16.71 | 4.46 | 15.65 |
| | 24 | 210 | 48 | 13.35 | 0.22 | 210 | 47 | 36.10 | 20.60 | 15.80 | 16.70 | 4.41 | 15.60 |
| | 25 | 211 | 47 | 58.84 | -0.07 | 211 | 47 | 21.62 | 20.61 | +15.93 | -16.65 | +4.37 | 15.56 |
| | 26 | 212 | 47 | 46.47 | +0.04 | 212 | 47 | 09.31 | 20.62 | 16.07 | 16.59 | 4.35 | 15.54 |
| | 27 | 213 | 47 | 36.29 | 0.14 | 213 | 46 | 59.20 | 20.62 | 16.21 | 16.51 | 4.34 | 15.53 |
| | 28 | 214 | 47 | 28.27 | 0.22 | 214 | 46 | 51.24 | 20.63 | 16.35 | 16.45 | 4.35 | 15.53 |
| | 29 | 215 | 47 | 22.47 | 0.25 | 215 | 46 | 45.48 | 20.63 | 16.49 | 16.41 | 4.37 | 15.56 |
| | 30 | 216 | 47 | 18.87 | 0.29 | 216 | 46 | 41.88 | 20.64 | 16.63 | 16.40 | 4.41 | 15.59 |
| | 31 | 217 | 47 | 17.44 | +0.29 | 217 | 46 | 40.40 | 20.64 | +16.77 | -16.44 | +4.44 | 15.62 |
| Nov | 1 | 218 | 47 | 18.21 | 0.25 | 218 | 46 | 41.09 | 20.65 | 16.91 | 16.52 | 4.47 | 15.65 |
| | 2 | 219 | 47 | 21.05 | 0.22 | 219 | 46 | 43.82 | 20.65 | 17.05 | 16.62 | 4.48 | 15.66 |
| | 3 | 220 | 47 | 26.00 | +0.11 | 220 | 46 | 48.65 | 20.66 | 17.19 | 16.74 | 4.46 | 15.64 |
| | 4 | 221 | 47 | 32.90 | 0.00 | 221 | 46 | 55.45 | 20.66 | 17.32 | 16.83 | 4.42 | 15.59 |
| | 5 | 222 | 47 | 41.75 | -0.14 | 222 | 47 | 04.27 | 20.67 | 17.46 | 16.86 | 4.35 | 15.53 |
| | 6 | 223 | 47 | 52.37 | -0.29 | 223 | 47 | 14.93 | 20.67 | +17.60 | -16.81 | +4.28 | 15.45 |
| | 7 | 224 | 48 | 04.75 | 0.43 | 224 | 47 | 27.42 | 20.68 | 17.74 | 16.70 | 4.22 | 15.39 |
| | 8 | 225 | 48 | 18.71 | 0.58 | 225 | 47 | 41.53 | 20.68 | 17.88 | 16.54 | 4.18 | 15.35 |
| | 9 | 226 | 48 | 34.21 | 0.72 | 226 | 47 | 57.19 | 20.69 | 18.02 | 16.37 | 4.17 | 15.34 |
| | 10 | 227 | 48 | 51.18 | 0.79 | 227 | 48 | 14.29 | 20.69 | 18.16 | 16.24 | 4.19 | 15.36 |
| | 11 | 228 | 49 | 09.57 | 0.86 | 228 | 48 | 32.76 | 20.70 | 18.30 | 16.16 | 4.23 | 15.40 |
| | 12 | 229 | 49 | 29.39 | -0.94 | 229 | 48 | 52.60 | 20.70 | +18.44 | -16.14 | +4.27 | 15.44 |
| | 13 | 230 | 49 | 50.60 | 0.94 | 230 | 49 | 13.76 | 20.71 | 18.58 | 16.17 | 4.30 | 15.47 |
| | 14 | 231 | 50 | 13.18 | 0.90 | 231 | 49 | 36.26 | 20.71 | 18.72 | 16.25 | 4.32 | 15.49 |
| | 15 | 232 | 50 | 37.18 | 0.86 | 232 | 50 | 00.17 | 20.72 | 18.85 | 16.34 | 4.32 | 15.48 |
| | 16 | 233 | 51 | 02.58 | -0.79 | 233 | 50 | 25.48 | 20.72 | +18.99 | -16.43 | +4.30 | 15.46 |

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -18' 01".251 and subtract precession from J 2021.5.

**SUN, 2021**

FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Semi Diameter | | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | ' | " | h | m | s |
| Oct | 1 | 12 | 29 | 30.94 | -3 | 11 | 12.09 | 1.001 2734 | 15 | 58.42 | 11 | 49 | 34.28 |
| | 2 | 12 | 33 | 08.27 | 3 | 34 | 27.19 | 1.000 9930 | 15 | 58.69 | 11 | 49 | 15.21 |
| | 3 | 12 | 36 | 45.91 | 3 | 57 | 39.99 | 1.000 7115 | 15 | 58.96 | 11 | 48 | 56.47 |
| | 4 | 12 | 40 | 23.89 | 4 | 20 | 50.10 | 1.000 4288 | 15 | 59.23 | 11 | 48 | 38.07 |
| | 5 | 12 | 44 | 02.23 | 4 | 43 | 57.16 | 1.000 1446 | 15 | 59.51 | 11 | 48 | 20.05 |
| | 6 | 12 | 47 | 40.94 | 5 | 07 | 00.79 | 0.999 8590 | 15 | 59.78 | 11 | 48 | 02.40 |
| | 7 | 12 | 51 | 20.03 | -5 | 30 | 00.60 | 0.999 5718 | 16 | 00.06 | 11 | 47 | 45.16 |
| | 8 | 12 | 54 | 59.54 | 5 | 52 | 56.21 | 0.999 2831 | 16 | 00.33 | 11 | 47 | 28.32 |
| | 9 | 12 | 58 | 39.47 | 6 | 15 | 47.23 | 0.998 9931 | 16 | 00.61 | 11 | 47 | 11.91 |
| | 10 | 13 | 02 | 19.84 | 6 | 38 | 33.26 | 0.998 7020 | 16 | 00.89 | 11 | 46 | 55.95 |
| | 11 | 13 | 06 | 00.66 | 7 | 01 | 13.91 | 0.998 4102 | 16 | 01.17 | 11 | 46 | 40.44 |
| | 12 | 13 | 09 | 41.95 | 7 | 23 | 48.76 | 0.998 1181 | 16 | 01.45 | 11 | 46 | 25.41 |
| | 13 | 13 | 13 | 23.73 | -7 | 46 | 17.42 | 0.997 8261 | 16 | 01.74 | 11 | 46 | 10.87 |
| | 14 | 13 | 17 | 06.01 | 8 | 08 | 39.50 | 0.997 5345 | 16 | 02.02 | 11 | 45 | 56.84 |
| | 15 | 13 | 20 | 48.80 | 8 | 30 | 54.62 | 0.997 2440 | 16 | 02.30 | 11 | 45 | 43.35 |
| | 16 | 13 | 24 | 32.14 | 8 | 53 | 02.39 | 0.996 9547 | 16 | 02.58 | 11 | 45 | 30.40 |
| | 17 | 13 | 28 | 16.03 | 9 | 15 | 02.46 | 0.996 6671 | 16 | 02.85 | 11 | 45 | 18.03 |
| | 18 | 13 | 32 | 00.50 | 9 | 36 | 54.46 | 0.996 3814 | 16 | 03.13 | 11 | 45 | 06.25 |
| | 19 | 13 | 35 | 45.58 | -9 | 58 | 38.02 | 0.996 0978 | 16 | 03.40 | 11 | 44 | 55.08 |
| | 20 | 13 | 39 | 31.27 | 10 | 20 | 12.81 | 0.995 8166 | 16 | 03.68 | 11 | 44 | 44.54 |
| | 21 | 13 | 43 | 17.61 | 10 | 41 | 38.45 | 0.995 5378 | 16 | 03.95 | 11 | 44 | 34.65 |
| | 22 | 13 | 47 | 04.61 | 11 | 02 | 54.59 | 0.995 2615 | 16 | 04.21 | 11 | 44 | 25.43 |
| | 23 | 13 | 50 | 52.29 | 11 | 24 | 00.86 | 0.994 9877 | 16 | 04.48 | 11 | 44 | 16.89 |
| | 24 | 13 | 54 | 40.67 | 11 | 44 | 56.89 | 0.994 7165 | 16 | 04.74 | 11 | 44 | 09.06 |
| | 25 | 13 | 58 | 29.76 | -12 | 05 | 42.30 | 0.994 4477 | 16 | 05.00 | 11 | 44 | 01.95 |
| | 26 | 14 | 02 | 19.59 | 12 | 26 | 16.71 | 0.994 1814 | 16 | 05.26 | 11 | 43 | 55.58 |
| | 27 | 14 | 06 | 10.16 | 12 | 46 | 39.73 | 0.993 9174 | 16 | 05.52 | 11 | 43 | 49.96 |
| | 28 | 14 | 10 | 01.48 | 13 | 06 | 50.98 | 0.993 6555 | 16 | 05.77 | 11 | 43 | 45.10 |
| | 29 | 14 | 13 | 53.58 | 13 | 26 | 50.03 | 0.993 3958 | 16 | 06.02 | 11 | 43 | 41.02 |
| | 30 | 14 | 17 | 46.46 | 13 | 46 | 36.51 | 0.993 1378 | 16 | 06.28 | 11 | 43 | 37.73 |
| | 31 | 14 | 21 | 40.13 | -14 | 06 | 09.98 | 0.992 8816 | 16 | 06.52 | 11 | 43 | 35.24 |
| Nov | 1 | 14 | 25 | 34.60 | 14 | 25 | 30.05 | 0.992 6269 | 16 | 06.77 | 11 | 43 | 33.56 |
| | 2 | 14 | 29 | 29.88 | 14 | 44 | 36.28 | 0.992 3734 | 16 | 07.02 | 11 | 43 | 32.69 |
| | 3 | 14 | 33 | 25.99 | 15 | 03 | 28.27 | 0.992 1210 | 16 | 07.27 | 11 | 43 | 32.65 |
| | 4 | 14 | 37 | 22.92 | 15 | 22 | 05.58 | 0.991 8696 | 16 | 07.51 | 11 | 43 | 33.44 |
| | 5 | 14 | 41 | 20.68 | 15 | 40 | 27.80 | 0.991 6190 | 16 | 07.76 | 11 | 43 | 35.05 |
| | 6 | 14 | 45 | 19.28 | -15 | 58 | 34.50 | 0.991 3692 | 16 | 08.00 | 11 | 43 | 37.49 |
| | 7 | 14 | 49 | 18.70 | 16 | 16 | 25.25 | 0.991 1205 | 16 | 08.24 | 11 | 43 | 40.76 |
| | 8 | 14 | 53 | 18.96 | 16 | 33 | 59.61 | 0.990 8729 | 16 | 08.48 | 11 | 43 | 44.86 |
| | 9 | 14 | 57 | 20.05 | 16 | 51 | 17.16 | 0.990 6269 | 16 | 08.72 | 11 | 43 | 49.79 |
| | 10 | 15 | 01 | 21.97 | 17 | 08 | 17.46 | 0.990 3829 | 16 | 08.96 | 11 | 43 | 55.55 |
| | 11 | 15 | 05 | 24.71 | 17 | 25 | 00.09 | 0.990 1412 | 16 | 09.20 | 11 | 44 | 02.13 |
| | 12 | 15 | 09 | 28.27 | -17 | 41 | 24.64 | 0.989 9023 | 16 | 09.43 | 11 | 44 | 09.55 |
| | 13 | 15 | 13 | 32.67 | 17 | 57 | 30.72 | 0.989 6665 | 16 | 09.66 | 11 | 44 | 17.80 |
| | 14 | 15 | 17 | 37.89 | 18 | 13 | 17.95 | 0.989 4342 | 16 | 09.89 | 11 | 44 | 26.87 |
| | 15 | 15 | 21 | 43.94 | 18 | 28 | 45.94 | 0.989 2057 | 16 | 10.12 | 11 | 44 | 36.78 |
| | 16 | 15 | 25 | 50.82 | -18 | 43 | 54.33 | 0.988 9813 | 16 | 10.34 | 11 | 44 | 47.52 |

**SUN, 2021**

FOR $0^h$ TERRESTRIAL TIME

| Date | | Geometric Longitude* (Mean Equinox of date) | | | Latitude ( Ecliptic of date ) | Apparent Longitude (True equinox of date) | | | Aberra-tion | Prec. in Long. ( J 2021.5 of date ) | Nut. in Long. | Nut. in Obliquity | True Obliquity (23° 26') |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | " | ° | ' | " | " | " | " | " | " |
| Nov | 16 | 233 | 51 | 02.58 | -0.79 | 233 | 50 | 25.48 | 20.72 | +18.99 | -16.43 | +4.30 | 15.46 |
| | 17 | 234 | 51 | 29.40 | 0.68 | 234 | 50 | 52.22 | 20.73 | 19.13 | 16.49 | 4.26 | 15.42 |
| | 18 | 235 | 51 | 57.70 | 0.58 | 235 | 51 | 20.48 | 20.73 | 19.27 | 16.53 | 4.21 | 15.37 |
| | 19 | 236 | 52 | 27.47 | 0.43 | 236 | 51 | 50.26 | 20.74 | 19.41 | 16.52 | 4.16 | 15.31 |
| | 20 | 237 | 52 | 58.78 | 0.32 | 237 | 52 | 21.61 | 20.74 | 19.55 | 16.48 | 4.10 | 15.26 |
| | 21 | 238 | 53 | 31.61 | 0.18 | 238 | 52 | 54.52 | 20.75 | 19.69 | 16.39 | 4.06 | 15.21 |
| | 22 | 239 | 54 | 06.00 | -0.07 | 239 | 53 | 29.00 | 20.75 | +19.83 | -16.29 | +4.03 | 15.18 |
| | 23 | 240 | 54 | 41.96 | +0.04 | 240 | 54 | 05.08 | 20.75 | 19.97 | 16.17 | 4.02 | 15.17 |
| | 24 | 241 | 55 | 19.51 | 0.14 | 241 | 54 | 42.73 | 20.76 | 20.11 | 16.06 | 4.02 | 15.17 |
| | 25 | 242 | 55 | 58.66 | 0.22 | 242 | 55 | 21.97 | 20.76 | 20.24 | 15.97 | 4.05 | 15.20 |
| | 26 | 243 | 56 | 39.43 | 0.25 | 243 | 56 | 02.80 | 20.77 | 20.38 | 15.92 | 4.08 | 15.23 |
| | 27 | 244 | 57 | 21.79 | 0.25 | 244 | 56 | 45.17 | 20.77 | 20.52 | 15.90 | 4.12 | 15.26 |
| | 28 | 245 | 58 | 05.77 | +0.25 | 245 | 57 | 29.12 | 20.77 | +20.66 | -15.92 | +4.15 | 15.30 |
| | 29 | 246 | 58 | 51.30 | 0.18 | 246 | 58 | 14.59 | 20.78 | 20.80 | 15.98 | 4.17 | 15.31 |
| | 30 | 247 | 59 | 38.43 | +0.11 | 247 | 59 | 01.64 | 20.78 | 20.94 | 16.05 | 4.17 | 15.31 |
| Dec | 1 | 249 | 00 | 27.02 | 0.00 | 248 | 59 | 50.17 | 20.78 | 21.08 | 16.11 | 4.14 | 15.29 |
| | 2 | 250 | 01 | 17.05 | -0.11 | 250 | 00 | 40.18 | 20.79 | 21.22 | 16.13 | 4.09 | 15.23 |
| | 3 | 251 | 02 | 08.45 | 0.25 | 251 | 01 | 31.62 | 20.79 | 21.36 | 16.08 | 4.03 | 15.17 |
| | 4 | 252 | 03 | 01.06 | -0.40 | 252 | 02 | 24.36 | 20.79 | +21.50 | -15.96 | +3.97 | 15.11 |
| | 5 | 253 | 03 | 54.84 | 0.54 | 253 | 03 | 18.32 | 20.80 | 21.64 | 15.77 | 3.93 | 15.06 |
| | 6 | 254 | 04 | 49.63 | 0.68 | 254 | 04 | 13.33 | 20.80 | 21.77 | 15.55 | 3.91 | 15.05 |
| | 7 | 255 | 05 | 45.31 | 0.79 | 255 | 05 | 09.20 | 20.80 | 21.91 | 15.35 | 3.94 | 15.07 |
| | 8 | 256 | 06 | 41.82 | 0.86 | 256 | 06 | 05.87 | 20.80 | 22.05 | 15.20 | 3.98 | 15.11 |
| | 9 | 257 | 07 | 39.02 | 0.94 | 257 | 07 | 03.14 | 20.81 | 22.19 | 15.12 | 4.03 | 15.17 |
| | 10 | 258 | 08 | 36.93 | -0.94 | 258 | 08 | 01.07 | 20.81 | +22.33 | -15.10 | +4.09 | 15.22 |
| | 11 | 259 | 09 | 35.39 | 0.94 | 259 | 08 | 59.50 | 20.81 | 22.47 | 15.13 | 4.12 | 15.25 |
| | 12 | 260 | 10 | 34.49 | 0.90 | 260 | 09 | 58.54 | 20.82 | 22.61 | 15.18 | 4.14 | 15.27 |
| | 13 | 261 | 11 | 34.13 | 0.83 | 261 | 10 | 58.12 | 20.82 | 22.75 | 15.24 | 4.13 | 15.26 |
| | 14 | 262 | 12 | 34.29 | 0.72 | 262 | 11 | 58.24 | 20.82 | 22.89 | 15.28 | 4.11 | 15.24 |
| | 15 | 263 | 13 | 35.04 | 0.61 | 263 | 12 | 58.97 | 20.82 | 23.03 | 15.30 | 4.08 | 15.20 |
| | 16 | 264 | 14 | 36.33 | -0.47 | 264 | 14 | 00.28 | 20.83 | +23.16 | -15.27 | +4.04 | 15.16 |
| | 17 | 265 | 15 | 38.15 | 0.36 | 265 | 15 | 02.16 | 20.83 | 23.30 | 15.21 | 4.00 | 15.12 |
| | 18 | 266 | 16 | 40.51 | 0.22 | 266 | 16 | 04.62 | 20.83 | 23.44 | 15.11 | 3.97 | 15.09 |
| | 19 | 267 | 17 | 43.49 | -0.07 | 267 | 17 | 07.73 | 20.83 | 23.58 | 14.98 | 3.95 | 15.07 |
| | 20 | 268 | 18 | 47.01 | +0.04 | 268 | 18 | 11.38 | 20.83 | 23.72 | 14.84 | 3.95 | 15.07 |
| | 21 | 269 | 19 | 51.17 | 0.14 | 269 | 19 | 15.67 | 20.83 | 23.86 | 14.71 | 3.97 | 15.08 |
| | 22 | 270 | 20 | 55.89 | +0.22 | 270 | 20 | 20.51 | 20.84 | +24.00 | -14.59 | +4.00 | 15.12 |
| | 23 | 271 | 22 | 01.25 | 0.25 | 271 | 21 | 25.96 | 20.84 | 24.14 | 14.51 | 4.05 | 15.16 |
| | 24 | 272 | 23 | 07.27 | 0.29 | 272 | 22 | 32.02 | 20.84 | 24.28 | 14.46 | 4.10 | 15.22 |
| | 25 | 273 | 24 | 13.87 | 0.29 | 273 | 23 | 38.62 | 20.84 | 24.42 | 14.46 | 4.15 | 15.27 |
| | 26 | 274 | 25 | 21.11 | 0.25 | 274 | 24 | 45.83 | 20.84 | 24.56 | 14.49 | 4.20 | 15.31 |
| | 27 | 275 | 26 | 28.99 | 0.18 | 275 | 25 | 53.65 | 20.84 | 24.69 | 14.55 | 4.22 | 15.33 |
| | 28 | 276 | 27 | 37.45 | +0.07 | 276 | 27 | 02.05 | 20.84 | +24.83 | -14.60 | +4.22 | 15.33 |
| | 29 | 277 | 28 | 46.49 | -0.04 | 277 | 28 | 11.06 | 20.84 | 24.97 | 14.63 | 4.20 | 15.30 |
| | 30 | 278 | 29 | 56.05 | 0.14 | 278 | 29 | 20.65 | 20.84 | 25.11 | 14.60 | 4.16 | 15.26 |
| | 31 | 279 | 31 | 06.01 | 0.29 | 279 | 30 | 30.71 | 20.84 | 25.25 | 14.51 | 4.12 | 15.22 |
| | 32 | 280 | 32 | 16.37 | -0.43 | 280 | 31 | 41.23 | 20.84 | +25.39 | -14.34 | +4.08 | 15.18 |

*To obtain the geometric longitude referred to the mean equinox of J 2000.0, add -18' 01".251 and subtract precession from J 2021.5.

**SUN, 2021**

FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Semi Diameter | | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | ' | " | h | m | s |
| Nov | 16 | 15 | 25 | 50.82 | -18 | 43 | 54.33 | 0.988 9813 | 16 | 10.34 | 11 | 44 | 47.52 |
| | 17 | 15 | 29 | 58.53 | 18 | 58 | 42.75 | 0.988 7612 | 16 | 10.55 | 11 | 44 | 59.08 |
| | 18 | 15 | 34 | 07.07 | 19 | 13 | 10.86 | 0.988 5455 | 16 | 10.76 | 11 | 45 | 11.48 |
| | 19 | 15 | 38 | 16.43 | 19 | 27 | 18.30 | 0.988 3345 | 16 | 10.97 | 11 | 45 | 24.69 |
| | 20 | 15 | 42 | 26.62 | 19 | 41 | 04.73 | 0.988 1282 | 16 | 11.17 | 11 | 45 | 38.72 |
| | 21 | 15 | 46 | 37.63 | 19 | 54 | 29.78 | 0.987 9267 | 16 | 11.37 | 11 | 45 | 53.57 |
| | 22 | 15 | 50 | 49.45 | -20 | 07 | 33.13 | 0.987 7299 | 16 | 11.57 | 11 | 46 | 09.22 |
| | 23 | 15 | 55 | 02.07 | 20 | 20 | 14.42 | 0.987 5378 | 16 | 11.76 | 11 | 46 | 25.67 |
| | 24 | 15 | 59 | 15.48 | -20 | 32 | 33.31 | 0.987 3505 | 16 | 11.94 | 11 | 46 | 42.91 |
| | 25 | 16 | 03 | 29.67 | 20 | 44 | 29.47 | 0.987 1678 | 16 | 12.12 | 11 | 47 | 00.92 |
| | 26 | 16 | 07 | 44.63 | 20 | 56 | 02.56 | 0.986 9895 | 16 | 12.29 | 11 | 47 | 19.70 |
| | 27 | 16 | 12 | 00.34 | 21 | 07 | 12.24 | 0.986 8155 | 16 | 12.47 | 11 | 47 | 39.23 |
| | 28 | 16 | 16 | 16.80 | -21 | 17 | 58.18 | 0.986 6457 | 16 | 12.63 | 11 | 47 | 59.49 |
| | 29 | 16 | 20 | 33.98 | 21 | 28 | 20.06 | 0.986 4798 | 16 | 12.80 | 11 | 48 | 20.48 |
| | 30 | 16 | 24 | 51.86 | -21 | 38 | 17.56 | 0.986 3175 | 16 | 12.96 | 11 | 48 | 42.16 |
| Dec | 1 | 16 | 29 | 10.44 | 21 | 47 | 50.38 | 0.986 1586 | 16 | 13.11 | 11 | 49 | 04.52 |
| | 2 | 16 | 33 | 29.68 | 21 | 56 | 58.22 | 0.986 0028 | 16 | 13.27 | 11 | 49 | 27.53 |
| | 3 | 16 | 37 | 49.56 | 22 | 05 | 40.78 | 0.985 8500 | 16 | 13.42 | 11 | 49 | 51.17 |
| | 4 | 16 | 42 | 10.06 | -22 | 13 | 57.80 | 0.985 6999 | 16 | 13.57 | 11 | 50 | 15.40 |
| | 5 | 16 | 46 | 31.15 | 22 | 21 | 49.00 | 0.985 5525 | 16 | 13.71 | 11 | 50 | 40.20 |
| | 6 | 16 | 50 | 52.79 | 22 | 29 | 14.14 | 0.985 4079 | 16 | 13.86 | 11 | 51 | 05.54 |
| | 7 | 16 | 55 | 14.95 | 22 | 36 | 12.95 | 0.985 2662 | 16 | 14.00 | 11 | 51 | 31.39 |
| | 8 | 16 | 59 | 37.59 | 22 | 42 | 45.18 | 0.985 1278 | 16 | 14.13 | 11 | 51 | 57.70 |
| | 9 | 17 | 04 | 00.68 | 22 | 48 | 50.62 | 0.984 9930 | 16 | 14.27 | 11 | 52 | 24.45 |
| | 10 | 17 | 08 | 24.19 | -22 | 54 | 29.05 | 0.984 8621 | 16 | 14.40 | 11 | 52 | 51.62 |
| | 11 | 17 | 12 | 48.10 | 22 | 59 | 40.28 | 0.984 7355 | 16 | 14.52 | 11 | 53 | 19.16 |
| | 12 | 17 | 17 | 12.37 | 23 | 04 | 24.15 | 0.984 6135 | 16 | 14.64 | 11 | 53 | 47.06 |
| | 13 | 17 | 21 | 36.97 | 23 | 08 | 40.52 | 0.984 4965 | 16 | 14.76 | 11 | 54 | 15.28 |
| | 14 | 17 | 26 | 01.89 | 23 | 12 | 29.24 | 0.984 3847 | 16 | 14.87 | 11 | 54 | 43.79 |
| | 15 | 17 | 30 | 27.08 | 23 | 15 | 50.22 | 0.984 2783 | 16 | 14.97 | 11 | 55 | 12.56 |
| | 16 | 17 | 34 | 52.52 | -23 | 18 | 43.34 | 0.984 1776 | 16 | 15.07 | 11 | 55 | 41.56 |
| | 17 | 17 | 39 | 18.17 | 23 | 21 | 08.53 | 0.984 0827 | 16 | 15.17 | 11 | 56 | 10.77 |
| | 18 | 17 | 43 | 44.02 | 23 | 23 | 05.71 | 0.983 9938 | 16 | 15.26 | 11 | 56 | 40.15 |
| | 19 | 17 | 48 | 10.03 | 23 | 24 | 34.83 | 0.983 9109 | 16 | 15.34 | 11 | 57 | 09.67 |
| | 20 | 17 | 52 | 36.16 | 23 | 25 | 35.83 | 0.983 8342 | 16 | 15.41 | 11 | 57 | 39.30 |
| | 21 | 17 | 57 | 02.39 | 23 | 26 | 08.68 | 0.983 7636 | 16 | 15.48 | 11 | 58 | 09.01 |
| | 22 | 18 | 01 | 28.69 | -23 | 26 | 13.35 | 0.983 6991 | 16 | 15.55 | 11 | 58 | 38.77 |
| | 23 | 18 | 05 | 55.01 | 23 | 25 | 49.82 | 0.983 6407 | 16 | 15.61 | 11 | 59 | 08.55 |
| | 24 | 18 | 10 | 21.34 | 23 | 24 | 58.09 | 0.983 5881 | 16 | 15.66 | 11 | 59 | 38.32 |
| | 25 | 18 | 14 | 47.63 | 23 | 23 | 38.17 | 0.983 5414 | 16 | 15.70 | 12 | 00 | 08.04 |
| | 26 | 18 | 19 | 13.86 | 23 | 21 | 50.07 | 0.983 5002 | 16 | 15.74 | 12 | 00 | 37.69 |
| | 27 | 18 | 23 | 40.00 | 23 | 19 | 33.82 | 0.983 4645 | 16 | 15.78 | 12 | 01 | 07.23 |
| | 28 | 18 | 28 | 06.02 | -23 | 16 | 49.48 | 0.983 4338 | 16 | 15.81 | 12 | 01 | 36.63 |
| | 29 | 18 | 32 | 31.88 | 23 | 13 | 37.09 | 0.983 4078 | 16 | 15.84 | 12 | 02 | 05.86 |
| | 30 | 18 | 36 | 57.56 | 23 | 09 | 56.75 | 0.983 3864 | 16 | 15.86 | 12 | 02 | 34.88 |
| | 31 | 18 | 41 | 23.01 | 23 | 05 | 48.56 | 0.983 3691 | 16 | 15.87 | 12 | 03 | 03.65 |
| | 32 | 18 | 45 | 48.21 | -23 | 01 | 12.64 | 0.983 3556 | 16 | 15.89 | 12 | 03 | 32.15 |

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EQUATORIAL RECTANGULAR CO-ORDINATES FOR $0^h$ TERRESTRIAL TIME
MEAN EQUATOR AND EQUINOX OF J 2021.5 AND J 2000.0

| Date | | $X_{2021.5}$ | $X_{2000.0}$ | $Y_{2021.5}$ | $Y_{2000.0}$ | $Z_{2021.5}$ | $Z_{2000.0}$ |
|---|---|---|---|---|---|---|---|
| Jan. | 0 | +0.162 7041 | +0.161 8984 | -0.889 8477 | -0.889 8458 | -0.385 4011 | -0.385 7446 |
| | 1 | 0.179 9192 | 0.179 1160 | 0.887 0540 | 0.887 0522 | 0.384 1536 | 0.384 5331 |
| | 2 | 0.197 0792 | 0.196 2788 | 0.883 9854 | 0.883 9836 | 0.382 7872 | 0.383 2025 |
| | 3 | 0.214 1790 | 0.213 3817 | 0.880 6427 | 0.880 6408 | 0.381 3021 | 0.381 7532 |
| | 4 | 0.231 2136 | 0.230 4196 | 0.877 0266 | 0.877 0247 | 0.379 6989 | 0.380 1855 |
| | 5 | 0.248 1778 | 0.247 3874 | 0.873 1378 | 0.873 1360 | -0.377 9778 | 0.378 4998 |
| | 6 | +0.265 0665 | +0.264 2799 | -0.868 9774 | -0.868 9756 | -0.376 1392 | -0.376 6965 |
| | 7 | 0.281 8745 | 0.281 0919 | 0.864 5461 | 0.864 5443 | 0.374 1836 | 0.374 7760 |
| | 8 | 0.298 5963 | 0.297 8180 | 0.859 8450 | 0.859 8433 | 0.372 1114 | 0.372 7387 |
| | 9 | 0.315 2266 | 0.314 4528 | 0.854 8753 | 0.854 8736 | 0.369 9230 | 0.370 5850 |
| | 10 | 0.331 7599 | 0.330 9909 | 0.849 6383 | 0.849 6365 | 0.367 6190 | 0.368 3155 |
| | 11 | 0.348 1906 | 0.347 4267 | 0.844 1353 | 0.844 1336 | 0.365 1999 | 0.365 9308 |
| | 12 | 0.364 5133 | +0.363 7546 | -0.838 3681 | -0.838 3664 | -0.362 6666 | -0.363 4315 |
| | 13 | 0.380 7225 | 0.379 9693 | 0.832 3386 | 0.832 3369 | 0.360 0197 | 0.360 8184 |
| | 14 | 0.396 8126 | 0.396 0651 | 0.826 0487 | 0.826 0470 | 0.357 2601 | 0.358 0924 |
| | 15 | 0.412 7784 | 0.412 0369 | 0.819 5006 | 0.819 4990 | 0.354 3888 | 0.355 2544 |
| | 16 | 0.428 6146 | 0.427 8793 | 0.812 6968 | 0.812 6952 | 0.351 4067 | 0.352 3054 |
| | 17 | 0.444 3162 | 0.443 5873 | 0.805 6397 | 0.805 6381 | 0.348 3149 | 0.349 2464 |
| | 18 | +0.459 8782 | +0.459 1560 | -0.798 3319 | -0.798 3303 | -0.345 1146 | -0.346 0785 |
| | 19 | 0.475 2957 | 0.474 5804 | 0.790 7759 | 0.790 7744 | 0.341 8068 | 0.342 8030 |
| | 20 | 0.490 5641 | 0.489 8559 | 0.782 9746 | 0.782 9730 | 0.338 3929 | 0.339 4209 |
| | 21 | 0.505 6787 | 0.504 9778 | 0.774 9305 | 0.774 9290 | 0.334 8739 | 0.335 9335 |
| | 22 | 0.520 6351 | 0.519 9417 | 0.766 6466 | 0.766 6451 | 0.331 2512 | 0.332 3420 |
| | 23 | 0.535 4287 | 0.534 7431 | 0.758 1257 | 0.758 1243 | 0.327 5260 | 0.328 6477 |
| | 24 | +0.550 0553 | +0.549 3777 | -0.749 3707 | -0.749 3692 | -0.323 6996 | -0.324 8518 |
| | 25 | 0.564 5107 | 0.563 8412 | 0.740 3845 | 0.7403 8304 | 0.319 7733 | 0.320 9557 |
| | 26 | 0.578 7908 | 0.578 1296 | 0.731 1700 | 0.7311 6858 | 0.3157 4848 | 0.316 9606 |
| | 27 | 0.592 8914 | 0.592 2389 | 0.721 7302 | 0.7217 2884 | 0.3116 2637 | 0.312 8679 |
| | 28 | 0.606 8087 | 0.606 1649 | 0.712 0681 | 0.7120 6679 | 0.3074 0834 | 0.308 6789 |
| | 29 | 0.620 5387 | 0.619 9040 | 0.702 1867 | 0.7021 8540 | 0.3030 9572 | 0.304 3949 |
| | 30 | +0.634 0777 | +0.633 4521 | -0.692 0889 | -0.692 0876 | -0.298 6898 | -0.300 0173 |
| | 31 | 0.647 4217 | 0.646 8055 | -0.681 7777 | 0.6817 7640 | 0.294 1920 | 0.295 5473 |
| Feb. | 1 | 0.660 5670 | 0.659 9604 | 0.671 2559 | 0.6712 5469 | 0.289 6035 | 0.290 9862 |
| | 2 | 0.673 5097 | 0.672 9128 | 0.660 5267 | 0.6605 2546 | 0.284 9256 | 0.286 3353 |
| | 3 | 0.686 2459 | 0.685 6589 | 0.649 5929 | 0.6495 9173 | 0.280 1596 | 0.281 5959 |
| | 4 | 0.698 7716 | 0.698 1947 | 0.638 4578 | 0.6384 5659 | 0.275 3070 | 0.276 7694 |
| | 5 | +0.711 0829 | +0.710 5163 | -0.627 1244 | -0.627 1232 | -0.270 3689 | -0.271 8570 |
| | 6 | 0.723 1758 | 0.722 6196 | 0.615 5961 | 0.6155 9497 | 0.265 3469 | 0.266 8602 |
| | 7 | 0.735 0462 | 0.734 5008 | 0.603 8763 | 0.6038 7526 | 0.260 2425 | 0.261 7805 |
| | 8 | 0.746 6904 | 0.746 1557 | 0.591 9688 | 0.5919 6771 | 0.255 0571 | 0.256 6194 |
| | 9 | 0.758 1043 | 0.757 5806 | 0.579 8771 | 0.5798 7609 | 0.249 7923 | 0.251 3784 |
| | 10 | 0.769 2841 | 0.768 7716 | 0.567 6053 | 0.5676 0430 | 0.244 4498 | 0.246 0592 |
| | 11 | +0.780 2262 | +0.779 7250 | -0.555 1574 | -0.555 1564 | -0.239 0314 | -0.240 6636 |
| | 12 | 0.790 9271 | 0.790 4373 | 0.542 5375 | 0.5425 3655 | 0.233 5388 | 0.235 1933 |
| | 13 | 0.801 3833 | 0.800 9051 | 0.529 7499 | 0.5297 4902 | 0.227 9739 | 0.229 6502 |
| | 14 | 0.811 5917 | 0.811 1252 | 0.516 7990 | 0.5167 9815 | 0.222 3385 | 0.224 0361 |
| | 15 | +0.821 5491 | +0.821 0946 | -0.503 6892 | -0.5036 8832 | -0.216 6347 | -0.218 3530 |

**SUN, 2021**

EQUATORIAL RECTANGULAR CO-ORDINATES FOR $0^h$ TERRESTRIAL TIME
MEAN EQUATOR AND EQUINOX OF J 2021.5 AND J 2000.0

| Date | | $X_{2021.5}$ | $X_{2000.0}$ | $Y_{2021.5}$ | $Y_{2000.0}$ | $Z_{2021.5}$ | $Z_{2000.0}$ |
|---|---|---|---|---|---|---|---|
| Feb. | 15 | +0.821 5491 | +0.821 0946 | -0.503 6892 | -0.503 6883 | -0.216 6347 | -0.218 3530 |
| | 16 | 0.831 2527 | 0.830 8102 | 0.490 4248 | 0.490 4240 | 0.210 8642 | 0.212 6027 |
| | 17 | 0.840 6998 | 0.840 2695 | 0.477 0103 | 0.477 0095 | 0.205 0290 | 0.206 7873 |
| | 18 | 0.849 8876 | 0.849 4696 | 0.463 4502 | 0.463 4495 | 0.199 1312 | 0.200 9086 |
| | 19 | 0.858 8139 | 0.858 4083 | 0.449 7490 | 0.449 7483 | 0.193 1727 | 0.194 9686 |
| | 20 | 0.867 4761 | 0.867 0831 | 0.435 9111 | 0.435 9104 | 0.187 1553 | 0.188 9693 |
| | 21 | +0.875 8720 | +0.875 4917 | -0.421 9409 | -0.421 9403 | -0.181 0812 | -0.182 9127 |
| | 22 | 0.883 9996 | 0.883 6321 | 0.407 8431 | 0.407 8425 | 0.174 9523 | 0.176 8007 |
| | 23 | 0.891 8569 | 0.891 5023 | 0.393 6219 | 0.393 6214 | 0.168 7705 | 0.170 6353 |
| | 24 | 0.899 4419 | 0.899 1003 | 0.379 2819 | 0.379 2814 | 0.162 5379 | 0.164 4184 |
| | 25 | 0.906 7530 | 0.906 4244 | 0.364 8275 | 0.364 8269 | 0.156 2563 | 0.158 1520 |
| | 26 | 0.913 7883 | 0.913 4730 | 0.350 2628 | 0.350 2624 | 0.149 9276 | 0.151 8380 |
| | 27 | +0.920 5463 | +0.920 2443 | -0.335 5924 | -0.335 5920 | -0.143 5538 | -0.145 4782 |
| | 28 | 0.927 0254 | 0.926 7368 | 0.320 8203 | 0.320 8199 | 0.137 1367 | 0.139 0746 |
| Mar. | 1 | 0.933 2239 | 0.932 9488 | 0.305 9509 | 0.305 9505 | 0.130 6781 | 0.132 6289 |
| | 2 | 0.939 1403 | 0.938 8788 | 0.290 9882 | 0.290 9878 | 0.124 1798 | 0.126 1430 |
| | 3 | 0.944 7730 | 0.944 5250 | 0.275 9365 | 0.275 9362 | 0.117 6437 | 0.119 6186 |
| | 4 | 0.950 1201 | 0.949 8859 | 0.260 8000 | 0.260 7997 | 0.111 0716 | 0.113 0576 |
| | 5 | +0.955 1800 | +0.954 9596 | -0.245 5832 | -0.245 5829 | -0.104 4653 | -0.106 4618 |
| | 6 | 0.959 9511 | 0.959 7446 | 0.230 2904 | 0.230 2902 | 0.097 8268 | 0.099 8331 |
| | 7 | 0.964 4317 | 0.964 2391 | 0.214 9262 | 0.214 9261 | 0.091 1579 | 0.093 1736 |
| | 8 | 0.968 6202 | 0.968 4416 | 0.199 4954 | 0.199 4953 | 0.084 4607 | 0.086 4851 |
| | 9 | 0.972 5153 | 0.972 3507 | 0.184 0028 | 0.184 0027 | 0.077 7372 | 0.079 7696 |
| | 10 | 0.976 1156 | 0.975 9651 | 0.168 4531 | 0.168 4531 | 0.070 9895 | 0.073 0294 |
| | 11 | +0.979 4200 | +0.979 2836 | -0.152 8514 | -0.152 8514 | -0.064 2198 | -0.066 2665 |
| | 12 | 0.982 4274 | 0.982 3052 | 0.137 2028 | 0.137 2028 | 0.057 4302 | 0.059 4831 |
| | 13 | 0.985 1371 | 0.985 0291 | 0.121 5121 | 0.121 5122 | 0.050 6228 | 0.052 6814 |
| | 14 | 0.987 5483 | 0.987 4546 | 0.105 7846 | 0.105 7847 | 0.043 8000 | 0.045 8635 |
| | 15 | 0.989 6606 | 0.989 5812 | 0.090 0253 | 0.090 0254 | 0.036 9638 | 0.039 0316 |
| | 16 | 0.991 4736 | 0.991 4085 | 0.074 2392 | 0.074 2394 | 0.030 1165 | 0.032 1881 |
| | 17 | +0.992 9872 | +0.992 9364 | -0.058 4315 | -0.058 4316 | -0.023 2603 | -0.025 3350 |
| | 18 | 0.994 2013 | 0.994 1648 | 0.042 6070 | 0.042 6072 | 0.016 3975 | 0.018 4746 |
| | 19 | 0.995 1159 | 0.995 0938 | 0.026 7707 | 0.026 7710 | 0.009 5301 | 0.011 6091 |
| | 20 | 0.995 7314 | 0.995 7236 | -0.010 9276 | -0.010 9279 | -0.002 6603 | -0.004 7405 |
| | 21 | 0.996 0480 | 0.996 0546 | +0.004 9174 | +0.004 9171 | +0.004 2097 | +0.002 1289 |
| | 22 | 0.996 0662 | 0.996 0871 | 0.020 7596 | 0.020 7593 | 0.011 0779 | 0.008 9971 |
| | 23 | +0.995 7865 | +0.995 8218 | +0.036 5942 | +0.036 5938 | +0.017 9420 | +0.015 8619 |
| | 24 | 0.995 2097 | 0.995 2593 | 0.052 4165 | 0.052 4161 | 0.024 8001 | 0.022 7213 |
| | 25 | 0.994 3365 | 0.994 4004 | 0.068 2220 | 0.068 2215 | 0.031 6502 | 0.029 5732 |
| | 26 | 0.993 1677 | 0.993 2459 | 0.084 0059 | 0.084 0054 | 0.038 4902 | 0.036 4157 |
| | 27 | 0.991 7042 | 0.991 7968 | 0.099 7641 | 0.099 7636 | 0.045 3182 | 0.043 2469 |
| | 28 | 0.989 9470 | 0.990 0538 | 0.115 4921 | 0.115 4915 | 0.052 1324 | 0.050 0648 |
| | 29 | +0.987 8969 | +0.988 0179 | +0.131 1857 | +0.131 1851 | +0.058 9309 | +0.056 8676 |
| | 30 | 0.985 5549 | 0.985 6901 | 0.146 8406 | 0.146 8400 | 0.065 7119 | 0.063 6535 |
| | 31 | 0.982 9216 | 0.983 0709 | 0.162 4527 | 0.162 4520 | 0.072 4735 | 0.070 4208 |
| Apr. | 1 | 0.979 9980 | 0.980 1614 | 0.178 0178 | 0.178 0171 | 0.079 2141 | 0.077 1675 |
| | 2 | +0.976 7846 | +0.976 9621 | +0.193 5314 | +0.193 5307 | +0.085 9317 | +0.083 8919 |

**SUN, 2021**

EQUATORIAL RECTANGULAR CO-ORDINATES FOR $0^h$ TERRESTRIAL TIME
MEAN EQUATOR AND EQUINOX OF J 2021.5 AND J 2000.0

| Date | | $X_{2021.5}$ | $X_{2000.0}$ | $Y_{2021.5}$ | $Y_{2000.0}$ | $Z_{2021.5}$ | $Z_{2000.0}$ |
|---|---|---|---|---|---|---|---|
| Apr. | 1 | +0.979 9980 | +0.980 1614 | +0.178 0178 | +0.178 0171 | +0.079 2141 | +0.077 1675 |
| | 2 | 0.976 7846 | 0.976 9621 | 0.193 5314 | 0.193 5307 | 0.085 9317 | 0.083 8919 |
| | 3 | 0.973 2824 | 0.973 4739 | 0.208 9893 | 0.208 9885 | 0.092 6245 | 0.090 5921 |
| | 4 | 0.969 4922 | 0.969 6976 | 0.224 3869 | 0.224 3861 | 0.099 2907 | 0.097 2662 |
| | 5 | 0.965 4148 | 0.965 6341 | 0.239 7196 | 0.239 7188 | 0.105 9282 | 0.103 9123 |
| | 6 | 0.961 0515 | 0.961 2845 | 0.254 9829 | 0.254 9820 | 0.112 5351 | 0.110 5284 |
| | 7 | +0.956 4033 | +0.956 6502 | +0.270 1721 | +0.270 1712 | +0.119 1094 | +0.117 1125 |
| | 8 | 0.951 4718 | 0.951 7323 | 0.285 2824 | 0.285 2815 | 0.125 6491 | 0.123 6625 |
| | 9 | 0.946 2583 | 0.946 5324 | 0.300 3093 | 0.300 3084 | 0.132 1522 | 0.130 1766 |
| | 10 | 0.940 7647 | 0.941 0523 | 0.315 2481 | 0.315 2471 | 0.138 6166 | 0.136 6526 |
| | 11 | 0.934 9926 | 0.935 2937 | 0.330 0941 | 0.330 0931 | 0.145 0404 | 0.143 0885 |
| | 12 | 0.928 9441 | 0.929 2585 | 0.344 8428 | 0.344 8418 | 0.151 4216 | 0.149 4824 |
| | 13 | +0.922 6213 | +0.922 9490 | +0.359 4897 | +0.359 4886 | +0.157 7582 | +0.155 8322 |
| | 14 | 0.916 0265 | 0.916 3673 | 0.374 0302 | 0.374 0291 | 0.164 0482 | 0.162 1361 |
| | 15 | 0.909 1619 | 0.909 5158 | 0.388 4601 | 0.388 4590 | 0.170 2897 | 0.168 3920 |
| | 16 | 0.902 0300 | 0.902 3969 | 0.402 7750 | 0.402 7739 | 0.176 4809 | 0.174 5981 |
| | 17 | 0.894 6335 | 0.895 0132 | 0.416 9707 | 0.416 9695 | 0.182 6199 | 0.180 7526 |
| | 18 | 0.886 9750 | 0.887 3674 | 0.431 0431 | 0.431 0418 | 0.188 7048 | 0.186 8536 |
| | 19 | +0.879 0573 | +0.879 4623 | +0.444 9880 | +0.444 9868 | +0.194 7339 | +0.192 8993 |
| | 20 | 0.870 8831 | 0.871 3007 | 0.458 8017 | 0.458 8004 | 0.200 7054 | 0.198 8879 |
| | 21 | 0.862 4555 | 0.862 8854 | 0.472 4802 | 0.472 4789 | 0.206 6178 | 0.204 8179 |
| | 22 | 0.853 7774 | 0.854 2196 | 0.486 0198 | 0.486 0185 | 0.212 4692 | 0.210 6876 |
| | 23 | 0.844 8519 | 0.845 3061 | 0.499 4169 | 0.499 4155 | 0.218 2582 | 0.216 4953 |
| | 24 | 0.835 6819 | 0.836 1482 | 0.512 6680 | 0.512 6666 | 0.223 9833 | 0.222 2395 |
| | 25 | +0.826 2705 | +0.826 7487 | +0.525 7697 | +0.525 7683 | +0.229 6429 | +0.227 9189 |
| | 26 | 0.816 6208 | 0.817 1106 | 0.538 7188 | 0.538 7174 | 0.235 2357 | 0.233 5319 |
| | 27 | 0.806 7357 | 0.807 2370 | 0.551 5121 | 0.551 5106 | 0.240 7603 | 0.239 0772 |
| | 28 | 0.796 6179 | 0.797 1307 | 0.564 1462 | 0.564 1448 | 0.246 2153 | 0.244 5534 |
| | 29 | 0.786 2703 | 0.786 7944 | 0.576 6182 | 0.576 6167 | 0.251 5994 | 0.249 9592 |
| | 30 | 0.775 6957 | 0.776 2309 | 0.588 9246 | 0.588 9230 | 0.256 9114 | 0.255 2933 |
| May | 1 | +0.764 8968 | +0.765 4430 | +0.601 0621 | +0.601 0605 | +0.262 1496 | +0.260 5541 |
| | 2 | 0.753 8764 | 0.754 4334 | 0.613 0273 | 0.613 0257 | 0.267 3128 | 0.265 7404 |
| | 3 | 0.742 6375 | 0.743 2052 | 0.624 8168 | 0.624 8152 | 0.272 3995 | 0.270 8506 |
| | 4 | 0.731 1832 | 0.731 7613 | 0.636 4270 | 0.636 4254 | 0.277 4081 | 0.275 8832 |
| | 5 | 0.719 5166 | 0.720 1051 | 0.647 8546 | 0.647 8529 | 0.282 3372 | 0.280 8367 |
| | 6 | 0.707 6411 | 0.708 2397 | 0.659 0959 | 0.659 0943 | 0.287 1854 | 0.285 7097 |
| | 7 | +0.695 5601 | +0.696 1688 | +0.670 1477 | +0.670 1460 | +0.291 9511 | +0.290 5007 |
| | 8 | 0.683 2773 | 0.683 8957 | 0.681 0066 | 0.681 0049 | 0.296 6329 | 0.295 2082 |
| | 9 | 0.670 7963 | 0.671 4244 | 0.691 6692 | 0.691 6675 | 0.301 2294 | 0.299 8308 |
| | 10 | 0.658 1210 | 0.658 7585 | 0.702 1325 | 0.702 1307 | 0.305 7391 | 0.304 3671 |
| | 11 | 0.645 2552 | 0.645 9019 | 0.712 3932 | 0.712 3914 | 0.310 1608 | 0.308 8157 |
| | 12 | 0.632 2029 | 0.632 8588 | 0.722 4484 | 0.722 4466 | 0.314 4930 | 0.313 1752 |
| | 13 | +0.618 9683 | +0.619 6331 | +0.732 2951 | +0.732 2933 | +0.318 7346 | +0.317 4445 |
| | 14 | 0.605 5556 | 0.606 2290 | 0.741 9306 | 0.741 9288 | 0.322 8841 | 0.321 6221 |
| | 15 | 0.591 9689 | 0.592 6509 | 0.751 3520 | 0.751 3502 | 0.326 9406 | 0.325 7070 |
| | 16 | 0.578 2127 | 0.578 9029 | 0.760 5569 | 0.760 5550 | 0.330 9027 | 0.329 6979 |
| | 17 | +0.564 2912 | +0.564 9895 | +0.769 5426 | +0.769 5408 | +0.334 7695 | +0.333 5938 |

**SUN, 2021**

EQUATORIAL RECTANGULAR CO-ORDINATES FOR $0^h$ TERRESTRIAL TIME
MEAN EQUATOR AND EQUINOX OF J 2021.5 AND J 2000.0

| Date | | $X_{2021.5}$ | $X_{2000.0}$ | $Y_{2021.5}$ | $Y_{2000.0}$ | $Z_{2021.5}$ | $Z_{2000.0}$ |
|---|---|---|---|---|---|---|---|
| May | 17 | +0.564 2912 | +0.564 9895 | +0.769 5426 | +0.769 5408 | +0.334 7695 | +0.333 5938 |
| | 18 | 0.550 2088 | 0.550 9151 | 0.778 3070 | 0.778 3051 | 0.338 5398 | 0.337 3935 |
| | 19 | 0.535 9700 | 0.536 6840 | 0.786 8476 | 0.786 8457 | 0.342 2127 | 0.341 0962 |
| | 20 | 0.521 5793 | 0.522 3008 | 0.795 1625 | 0.795 1606 | 0.345 7873 | 0.344 7009 |
| | 21 | 0.507 0411 | 0.507 7699 | 0.803 2496 | 0.803 2477 | 0.349 2626 | 0.348 2066 |
| | 22 | 0.492 3598 | 0.493 0956 | 0.811 1071 | 0.811 1051 | 0.352 6380 | 0.351 6127 |
| | 23 | +0.477 5397 | +0.478 2825 | +0.818 7332 | +0.818 7312 | +0.355 9125 | +0.354 9183 |
| | 24 | 0.462 5853 | 0.463 3347 | 0.826 1262 | 0.826 1243 | 0.359 0857 | 0.358 1227 |
| | 25 | 0.447 5007 | 0.448 2566 | 0.833 2848 | 0.833 2828 | 0.362 1567 | 0.361 2253 |
| | 26 | 0.432 2900 | 0.433 0521 | 0.840 2071 | 0.840 2052 | 0.365 1251 | 0.364 2254 |
| | 27 | 0.416 9572 | 0.417 7254 | 0.846 8918 | 0.846 8899 | 0.367 9901 | 0.367 1225 |
| | 28 | 0.401 5064 | 0.402 2803 | 0.853 3372 | 0.853 3352 | 0.370 7511 | 0.369 9158 |
| | 29 | +0.385 9415 | +0.386 7210 | +0.859 5416 | +0.859 5397 | +0.373 4075 | +0.372 6047 |
| | 30 | 0.370 2664 | 0.371 0513 | 0.865 5033 | 0.865 5013 | 0.375 9586 | 0.375 1886 |
| | 31 | 0.354 4853 | 0.355 2753 | 0.871 2206 | 0.871 2185 | 0.378 4035 | 0.377 6665 |
| June | 1 | 0.338 6025 | 0.339 3974 | 0.876 6915 | 0.876 6895 | 0.380 7417 | 0.380 0379 |
| | 2 | 0.322 6222 | 0.323 4218 | 0.881 9145 | 0.881 9125 | 0.382 9723 | 0.382 3019 |
| | 3 | 0.306 5488 | 0.307 3529 | 0.886 8878 | 0.886 8857 | 0.385 0947 | 0.384 4579 |
| | 4 | +0.290 3870 | +0.291 1954 | +0.891 6097 | +0.891 6077 | +0.387 1080 | +0.386 5050 |
| | 5 | 0.274 1414 | 0.274 9538 | 0.896 0789 | 0.896 0769 | 0.389 0118 | 0.388 4427 |
| | 6 | 0.257 8167 | 0.258 6328 | 0.900 2938 | 0.900 2917 | 0.390 8053 | 0.390 2704 |
| | 7 | 0.241 4176 | 0.242 2373 | 0.904 2531 | 0.904 2510 | 0.392 4880 | 0.391 9873 |
| | 8 | 0.224 9490 | 0.225 7720 | 0.907 9555 | 0.907 9535 | 0.394 0592 | 0.393 5930 |
| | 9 | 0.208 4158 | 0.209 2419 | 0.911 4000 | 0.911 3979 | 0.395 5185 | 0.395 0868 |
| | 10 | +0.191 8230 | +0.192 6519 | +0.914 5854 | +0.914 5834 | +0.396 8655 | +0.396 4685 |
| | 11 | 0.175 1755 | 0.176 0071 | 0.917 5110 | 0.917 5089 | 0.398 0996 | 0.397 7374 |
| | 12 | 0.158 4784 | 0.159 3123 | 0.920 1758 | 0.920 1738 | 0.399 2206 | 0.398 8933 |
| | 13 | 0.141 7367 | 0.142 5728 | 0.922 5793 | 0.922 5772 | 0.400 2281 | 0.399 9358 |
| | 14 | 0.124 9555 | 0.125 7935 | 0.924 7209 | 0.924 7188 | 0.401 1220 | 0.400 8647 |
| | 15 | 0.108 1399 | 0.108 9796 | 0.926 6001 | 0.926 5981 | 0.401 9019 | 0.401 6797 |
| | 16 | +0.091 2949 | +0.092 1360 | +0.928 2168 | +0.928 2148 | +0.402 5678 | +0.402 3808 |
| | 17 | 0.074 4254 | 0.075 2677 | 0.929 5708 | 0.929 5687 | 0.403 1195 | 0.402 9678 |
| | 18 | 0.057 5365 | 0.058 3798 | 0.930 6620 | 0.930 6600 | 0.403 5572 | 0.403 4408 |
| | 19 | 0.040 6331 | 0.041 4771 | 0.931 4906 | 0.931 4885 | 0.403 8808 | 0.403 7997 |
| | 20 | 0.023 7200 | 0.024 5644 | 0.932 0567 | 0.932 0547 | 0.404 0905 | 0.404 0448 |
| | 21 | +0.006 8017 | +0.007 6464 | 0.932 3606 | 0.932 3586 | 0.404 1864 | 0.404 1760 |
| | 22 | -0.010 1169 | -0.009 2723 | +0.932 4027 | +0.932 4007 | +0.404 1687 | +0.404 1936 |
| | 23 | 0.027 0316 | 0.026 1872 | 0.932 1834 | 0.932 1813 | 0.404 0376 | 0.404 0978 |
| | 24 | 0.043 9379 | 0.043 0940 | 0.931 7028 | 0.931 7008 | 0.403 7932 | 0.403 8888 |
| | 25 | 0.060 8316 | 0.059 9883 | 0.930 9614 | 0.930 9594 | 0.403 4358 | 0.403 5667 |
| | 26 | 0.077 7083 | 0.076 8660 | 0.929 9593 | 0.929 9573 | 0.402 9656 | 0.403 1317 |
| | 27 | 0.094 5638 | 0.093 7227 | 0.928 6967 | 0.928 6947 | 0.402 3826 | 0.402 5839 |
| | 28 | -0.111 3937 | -0.110 5540 | +0.927 1737 | +0.927 1717 | +0.401 6869 | +0.401 9234 |
| | 29 | 0.128 1936 | 0.127 3555 | 0.925 3906 | 0.925 3886 | 0.400 8787 | 0.401 1503 |
| | 30 | 0.144 9588 | 0.144 1226 | 0.923 3474 | 0.923 3455 | 0.399 9580 | 0.400 2646 |
| July | 1 | 0.161 6847 | 0.160 8507 | 0.921 0446 | 0.921 0426 | 0.398 9249 | 0.399 2665 |
| | 2 | -0.178 3668 | -0.177 5351 | +0.918 4823 | +0.918 4804 | +0.397 7797 | +0.398 1561 |

**SUN, 2021**

EQUATORIAL RECTANGULAR CO-ORDINATES FOR $0^h$ TERRESTRIAL TIME
MEAN EQUATOR AND EQUINOX OF J 2021.5 AND J 2000.0

| Date | | $X_{2021.5}$ | $X_{2000.0}$ | $Y_{2021.5}$ | $Y_{2000.0}$ | $Z_{2021.5}$ | $Z_{2000.0}$ |
|---|---|---|---|---|---|---|---|
| July | 1 | -0.161 6847 | -0.160 8507 | +0.921 0446 | +0.921 0426 | +0.398 9249 | +0.399 2665 |
| | 2 | 0.178 3668 | 0.177 5351 | 0.918 4823 | 0.918 4804 | 0.397 7797 | 0.398 1561 |
| | 3 | 0.195 0001 | 0.194 1710 | 0.915 6611 | 0.915 6592 | 0.396 5224 | 0.396 9335 |
| | 4 | 0.211 5798 | 0.210 7536 | 0.912 5815 | 0.912 5796 | 0.395 1534 | 0.395 5991 |
| | 5 | 0.228 1013 | 0.227 2781 | 0.909 2441 | 0.909 2422 | 0.393 6728 | 0.394 1530 |
| | 6 | 0.244 5595 | 0.243 7396 | 0.905 6497 | 0.905 6479 | 0.392 0810 | 0.392 5956 |
| | 7 | -0.260 9497 | -0.260 1333 | +0.901 7992 | +0.901 7973 | +0.390 3783 | +0.390 9271 |
| | 8 | 0.277 2668 | 0.276 4542 | 0.897 6935 | 0.897 6916 | 0.388 5651 | 0.389 1480 |
| | 9 | 0.293 5061 | 0.292 6975 | 0.893 3337 | 0.893 3318 | 0.386 6419 | 0.387 2587 |
| | 10 | 0.309 6627 | 0.308 8582 | 0.888 7210 | 0.888 7191 | 0.384 6093 | 0.385 2598 |
| | 11 | 0.325 7316 | 0.324 9316 | 0.883 8567 | 0.883 8549 | 0.382 4676 | 0.383 1517 |
| | 12 | 0.341 7080 | 0.340 9126 | 0.878 7423 | 0.878 7405 | 0.380 2176 | 0.380 9351 |
| | 13 | -0.357 5871 | -0.356 7966 | +0.873 3795 | +0.873 3777 | +0.377 8600 | +0.378 6106 |
| | 14 | 0.373 3641 | 0.372 5788 | 0.867 7698 | 0.867 7680 | 0.375 3954 | 0.376 1789 |
| | 15 | 0.389 0345 | 0.388 2545 | 0.861 9152 | 0.861 9134 | 0.372 8247 | 0.373 6409 |
| | 16 | 0.404 5936 | 0.403 8192 | 0.855 8176 | 0.855 8158 | 0.370 1487 | 0.370 9974 |
| | 17 | 0.420 0370 | 0.419 2684 | 0.849 4790 | 0.849 4773 | 0.367 3684 | 0.368 2494 |
| | 18 | 0.435 3604 | 0.434 5977 | 0.842 9016 | 0.842 8999 | 0.364 4846 | 0.365 3976 |
| | 19 | -0.450 5596 | -0.449 8031 | +0.836 0875 | +0.836 0858 | +0.361 4984 | +0.362 4431 |
| | 20 | 0.465 6305 | 0.464 8805 | 0.829 0388 | 0.829 0372 | 0.358 4108 | 0.359 3869 |
| | 21 | 0.480 5693 | 0.479 8259 | 0.821 7579 | 0.821 7563 | 0.355 2227 | 0.356 2300 |
| | 22 | 0.495 3720 | 0.494 6355 | 0.814 2468 | 0.814 2452 | 0.351 9351 | 0.352 9733 |
| | 23 | 0.510 0350 | 0.509 3055 | 0.806 5076 | 0.806 5060 | 0.348 5490 | 0.349 6178 |
| | 24 | 0.524 5546 | 0.523 8323 | 0.798 5423 | 0.798 5408 | 0.345 0653 | 0.346 1644 |
| | 25 | -0.538 9269 | -0.538 2121 | +0.790 3530 | +0.790 3515 | +0.341 4849 | +0.342 6140 |
| | 26 | 0.553 1483 | 0.552 4412 | 0.781 9417 | 0.781 9402 | 0.337 8087 | 0.338 9675 |
| | 27 | 0.567 2150 | 0.566 5156 | 0.773 3102 | 0.773 3087 | 0.334 0377 | 0.335 2258 |
| | 28 | 0.581 1229 | 0.580 4316 | 0.764 4608 | 0.764 4593 | 0.330 1725 | 0.331 3897 |
| | 29 | 0.594 8682 | 0.594 1852 | 0.755 3953 | 0.755 3939 | 0.326 2143 | 0.327 4601 |
| | 30 | 0.608 4469 | 0.607 7723 | 0.746 1161 | 0.746 1147 | 0.322 1639 | 0.323 4380 |
| | 31 | -0.621 8550 | -0.621 1890 | +0.736 6254 | +0.736 6240 | +0.318 0222 | +0.319 3244 |
| Aug. | 1 | 0.635 0885 | 0.634 4313 | 0.726 9255 | 0.726 9242 | 0.313 7904 | 0.315 1201 |
| | 2 | 0.648 1433 | 0.647 4951 | 0.717 0190 | 0.717 0177 | 0.309 4694 | 0.310 8264 |
| | 3 | 0.661 0155 | 0.660 3766 | 0.706 9084 | 0.706 9070 | 0.305 0603 | 0.306 4441 |
| | 4 | 0.673 7011 | 0.673 0715 | 0.696 5963 | 0.696 5950 | 0.300 5643 | 0.301 9746 |
| | 5 | 0.686 1962 | 0.685 5761 | 0.686 0855 | 0.686 0842 | 0.295 9826 | 0.297 4189 |
| | 6 | -0.698 4967 | -0.697 8864 | +0.675 3789 | +0.675 3777 | +0.291 3163 | +0.292 7783 |
| | 7 | 0.710 5989 | 0.709 9985 | 0.664 4795 | 0.664 4783 | 0.286 5667 | 0.288 0540 |
| | 8 | 0.722 4988 | 0.721 9085 | 0.653 3903 | 0.653 3891 | 0.281 7353 | 0.283 2473 |
| | 9 | 0.734 1927 | 0.733 6126 | 0.642 1147 | 0.642 1135 | 0.276 8232 | 0.278 3596 |
| | 10 | 0.745 6769 | 0.745 1072 | 0.630 6558 | 0.630 6547 | 0.271 8320 | 0.273 3924 |
| | 11 | 0.756 9478 | 0.756 3887 | 0.619 0173 | 0.619 0162 | 0.266 7633 | 0.268 3471 |
| | 12 | -0.768 0020 | -0.767 4535 | +0.607 2025 | +0.607 2015 | +0.261 6184 | +0.263 2253 |
| | 13 | 0.778 8360 | 0.778 2985 | 0.595 2153 | 0.595 2142 | 0.256 3991 | 0.258 0285 |
| | 14 | 0.789 4469 | 0.788 9204 | 0.583 0592 | 0.583 0582 | 0.251 1069 | 0.252 7585 |
| | 15 | 0.799 8315 | 0.799 3162 | 0.570 7380 | 0.570 7370 | 0.245 7434 | 0.247 4167 |
| | 16 | -0.809 9871 | -0.809 4831 | +0.558 2553 | +0.558 2544 | +0.240 3105 | +0.242 0049 |

**SUN, 2021**

EQUATORIAL RECTANGULAR CO-ORDINATES FOR $0^h$ TERRESTRIAL TIME
MEAN EQUATOR AND EQUINOX OF J 2021.5 AND J 2000.0

| Date | | $X_{2021.5}$ | $X_{2000.0}$ | $Y_{2021.5}$ | $Y_{2000.0}$ | $Z_{2021.5}$ | $Z_{2000.0}$ |
|---|---|---|---|---|---|---|---|
| Aug. | 16 | -0.809 9871 | -0.809 4831 | +0.558 2553 | +0.558 2544 | +0.240 3105 | +0.242 0049 |
| | 17 | 0.819 9109 | 0.819 4184 | 0.545 6150 | 0.545 6141 | 0.234 8096 | 0.236 5247 |
| | 18 | 0.829 6004 | 0.829 1195 | 0.532 8207 | 0.532 8198 | 0.229 2425 | 0.230 9778 |
| | 19 | 0.839 0531 | 0.838 5840 | 0.519 8761 | 0.519 8752 | 0.223 6107 | 0.225 3657 |
| | 20 | 0.848 2667 | 0.847 8095 | 0.506 7845 | 0.506 7837 | 0.217 9159 | 0.219 6901 |
| | 21 | 0.857 2387 | 0.856 7935 | 0.493 5497 | 0.493 5489 | 0.212 1596 | 0.213 9525 |
| | 22 | -0.865 9668 | -0.865 5337 | +0.480 1750 | +0.480 1743 | +0.206 3433 | +0.208 1544 |
| | 23 | 0.874 4487 | 0.874 0278 | 0.466 6639 | 0.466 6632 | 0.200 4686 | 0.202 2973 |
| | 24 | 0.882 6818 | 0.882 2733 | 0.453 0198 | 0.453 0191 | 0.194 5369 | 0.196 3827 |
| | 25 | 0.890 6638 | 0.890 2679 | 0.439 2463 | 0.439 2456 | 0.188 5497 | 0.190 4122 |
| | 26 | 0.898 3923 | 0.898 0089 | 0.425 3468 | 0.425 3462 | 0.182 5086 | 0.184 3872 |
| | 27 | 0.905 8647 | 0.905 4941 | 0.411 3249 | 0.411 3243 | 0.176 4151 | 0.178 3092 |
| | 28 | -0.913 0786 | -0.912 7208 | +0.397 1844 | +0.397 1838 | +0.170 2708 | +0.172 1800 |
| | 29 | 0.920 0316 | 0.919 6867 | 0.382 9290 | 0.382 9284 | 0.164 0773 | 0.166 0009 |
| | 30 | 0.926 7213 | 0.926 3894 | 0.368 5624 | 0.368 5619 | 0.157 8363 | 0.159 7738 |
| | 31 | 0.933 1452 | 0.932 8265 | 0.354 0888 | 0.354 0883 | 0.151 5493 | 0.153 5002 |
| Sept. | 1 | 0.939 3012 | 0.938 9957 | 0.339 5119 | 0.339 5115 | 0.145 2182 | 0.147 1818 |
| | 2 | 0.945 1869 | 0.944 8947 | 0.324 8360 | 0.324 8356 | 0.138 8446 | 0.140 8205 |
| | 3 | -0.950 8001 | -0.950 5213 | +0.310 0652 | +0.310 0648 | +0.132 4304 | +0.134 4179 |
| | 4 | 0.956 1387 | 0.955 8734 | 0.295 2037 | 0.295 2033 | 0.125 9773 | 0.127 9759 |
| | 5 | 0.961 2007 | 0.960 9489 | 0.280 2559 | 0.280 2556 | 0.119 4872 | 0.121 4964 |
| | 6 | 0.965 9840 | 0.965 7458 | 0.265 2262 | 0.265 2260 | 0.112 9622 | 0.114 9813 |
| | 7 | 0.970 4869 | 0.970 2624 | 0.250 1193 | 0.250 1190 | 0.106 4040 | 0.108 4324 |
| | 8 | 0.974 7076 | 0.974 4968 | 0.234 9396 | 0.234 9394 | 0.099 8147 | 0.101 8519 |
| | 9 | -0.978 6446 | -0.978 4477 | +0.219 6920 | +0.219 6919 | +0.093 1965 | +0.095 2418 |
| | 10 | 0.982 2965 | 0.982 1135 | 0.204 3812 | 0.204 3811 | 0.086 5512 | 0.088 6042 |
| | 11 | 0.985 6623 | 0.985 4932 | 0.189 0120 | 0.189 0119 | 0.079 8812 | 0.081 9411 |
| | 12 | 0.988 7409 | 0.988 5858 | 0.173 5890 | 0.173 5889 | 0.073 1884 | 0.075 2546 |
| | 13 | 0.991 5316 | 0.991 3905 | 0.158 1170 | 0.158 1170 | 0.066 4749 | 0.068 5469 |
| | 14 | 0.994 0336 | 0.993 9066 | 0.142 6006 | 0.142 6006 | 0.059 7427 | 0.061 8199 |
| | 15 | -0.996 2465 | -0.996 1336 | +0.127 0444 | +0.127 0444 | +0.052 9940 | +0.055 0757 |
| | 16 | 0.998 1699 | 0.998 0711 | 0.111 4527 | 0.111 4528 | 0.046 2306 | 0.048 3163 |
| | 17 | 0.999 8032 | 0.999 7186 | 0.095 8301 | 0.095 8302 | 0.039 4545 | 0.041 5435 |
| | 18 | 1.001 1462 | 1.001 0758 | 0.080 1808 | 0.080 1809 | 0.032 6675 | 0.034 7594 |
| | 19 | 1.002 1986 | 1.002 1423 | 0.064 5091 | 0.064 5092 | 0.025 8717 | 0.027 9656 |
| | 20 | 1.002 9598 | 1.002 9178 | 0.048 8192 | 0.048 8194 | 0.019 0687 | 0.021 1642 |
| | 21 | -1.003 4297 | -1.003 4019 | +0.033 1154 | +0.033 1156 | +0.012 2604 | +0.014 3568 |
| | 22 | 1.003 6079 | 1.003 5943 | 0.017 4019 | 0.017 4022 | +0.005 4487 | 0.007 5454 |
| | 23 | 1.003 4940 | 1.003 4946 | +0.001 6830 | +0.001 6833 | -0.001 3646 | +0.000 7318 |
| | 24 | 1.003 0876 | 1.003 1025 | -0.014 0369 | -0.014 0366 | -0.008 1777 | -0.006 0822 |
| | 25 | 1.002 3885 | 1.002 4176 | 0.029 7536 | 0.029 7532 | 0.014 9886 | 0.012 8947 |
| | 26 | 1.001 3964 | 1.001 4398 | 0.045 4626 | 0.045 4622 | 0.021 7956 | 0.019 7038 |
| | 27 | -1.000 1111 | -1.000 1687 | -0.061 1594 | -0.061 1590 | -0.028 5967 | -0.026 5076 |
| | 28 | 0.998 5325 | 0.998 6042 | 0.076 8395 | 0.076 8391 | 0.035 3900 | 0.033 3043 |
| | 29 | 0.996 6604 | 0.996 7464 | 0.092 4984 | 0.092 4979 | 0.042 1735 | 0.040 0917 |
| | 30 | 0.994 4949 | 0.994 5950 | 0.108 1314 | 0.108 1308 | 0.048 9452 | 0.046 8680 |
| Oct. | 1 | -0.992 0360 | -0.992 1503 | -0.123 7338 | -0.123 7333 | -0.055 7032 | -0.053 6312 |

**SUN, 2021**

EQUATORIAL RECTANGULAR CO-ORDINATES FOR $0^h$ TERRESTRIAL TIME
MEAN EQUATOR AND EQUINOX OF J 2021.5 AND J 2000.0

| Date | | $X_{2021.5}$ | $X_{2000.0}$ | $Y_{2021.5}$ | $Y_{2000.0}$ | $Z_{2021.5}$ | $Z_{2000.0}$ |
|---|---|---|---|---|---|---|---|
| Oct. | 1 | -0.992 0360 | -0.992 1503 | -0.123 7338 | -0.123 7333 | -0.055 7032 | -0.053 6312 |
| | 2 | 0.989 2840 | 0.989 4123 | 0.139 3010 | 0.139 3004 | 0.062 4454 | 0.060 3793 |
| | 3 | 0.986 2390 | 0.986 3814 | 0.154 8281 | 0.154 8275 | 0.069 1698 | 0.067 1101 |
| | 4 | 0.982 9014 | 0.983 0579 | 0.170 3103 | 0.170 3097 | 0.075 8742 | 0.073 8216 |
| | 5 | 0.979 2718 | 0.979 4422 | 0.185 7427 | 0.185 7420 | 0.082 5567 | 0.080 5116 |
| | 6 | 0.975 3509 | 0.975 5352 | 0.201 1203 | 0.201 1196 | 0.089 2149 | 0.087 1781 |
| | 7 | -0.971 1394 | -0.971 3376 | -0.216 4381 | -0.216 4373 | -0.095 8467 | -0.093 8188 |
| | 8 | 0.966 6385 | 0.966 8505 | 0.231 6911 | 0.231 6903 | 0.102 4500 | 0.100 4316 |
| | 9 | 0.961 8494 | 0.962 0751 | 0.246 8745 | 0.246 8736 | 0.109 0226 | 0.107 0142 |
| | 10 | 0.956 7737 | 0.957 0131 | 0.261 9832 | 0.261 9823 | 0.115 5622 | 0.113 5645 |
| | 11 | 0.951 4130 | 0.951 6660 | 0.277 0126 | 0.277 0117 | 0.122 0669 | 0.120 0804 |
| | 12 | 0.945 7691 | 0.946 0356 | 0.291 9580 | 0.291 9570 | 0.128 5345 | 0.126 5599 |
| | 13 | -0.939 8438 | -0.940 1238 | -0.306 8149 | -0.306 8139 | -0.134 9630 | -0.133 0009 |
| | 14 | 0.933 6392 | 0.933 9326 | 0.321 5789 | 0.321 5779 | 0.141 3506 | 0.139 4015 |
| | 15 | 0.927 1571 | 0.927 4638 | 0.336 2458 | 0.336 2448 | 0.147 6954 | 0.145 7599 |
| | 16 | 0.920 3996 | 0.920 7194 | 0.350 8114 | 0.350 8103 | 0.153 9955 | 0.152 0741 |
| | 17 | 0.913 3686 | 0.913 7015 | 0.365 2714 | 0.365 2703 | 0.160 2491 | 0.158 3425 |
| | 18 | 0.906 0662 | 0.906 4121 | 0.379 6219 | 0.379 6207 | 0.166 4545 | 0.164 5632 |
| | 19 | -0.898 4943 | -0.898 8531 | -0.393 8586 | -0.393 8575 | -0.172 6099 | -0.170 7345 |
| | 20 | 0.890 6549 | 0.891 0265 | 0.407 9777 | 0.407 9766 | 0.178 7137 | 0.176 8547 |
| | 21 | 0.882 5501 | 0.882 9343 | 0.421 9751 | 0.421 9739 | 0.184 7639 | 0.182 9219 |
| | 22 | 0.874 1820 | 0.874 5787 | 0.435 8466 | 0.435 8454 | 0.190 7591 | 0.188 9346 |
| | 23 | 0.865 5525 | 0.865 9616 | 0.449 5883 | 0.449 5870 | 0.196 6973 | 0.194 8909 |
| | 24 | 0.856 6638 | 0.857 0853 | 0.463 1960 | 0.463 1948 | 0.202 5769 | 0.200 7892 |
| | 25 | -0.847 5182 | -0.847 9518 | -0.476 6658 | -0.476 6645 | -0.208 3962 | -0.206 6276 |
| | 26 | 0.838 1178 | 0.838 5635 | 0.489 9934 | 0.489 9921 | 0.214 1534 | 0.212 4045 |
| | 27 | 0.828 4650 | 0.828 9226 | 0.503 1749 | 0.503 1735 | 0.219 8468 | 0.218 1181 |
| | 28 | 0.818 5622 | 0.819 0316 | 0.516 2059 | 0.516 2045 | 0.225 4745 | 0.223 7666 |
| | 29 | 0.808 4118 | 0.808 8929 | 0.529 0825 | 0.529 0811 | 0.231 0349 | 0.229 3482 |
| | 30 | 0.798 0165 | 0.798 5090 | 0.541 8005 | 0.541 7991 | 0.236 5262 | 0.234 8613 |
| | 31 | -0.787 3789 | -0.787 8828 | -0.554 3557 | -0.554 3542 | -0.241 9466 | -0.240 3039 |
| Nov. | 1 | 0.776 5018 | 0.777 0169 | 0.566 7439 | 0.566 7424 | 0.247 2942 | 0.245 6744 |
| | 2 | 0.765 3881 | 0.765 9142 | 0.578 9610 | 0.578 9595 | 0.252 5673 | 0.250 9707 |
| | 3 | 0.754 0409 | 0.754 5779 | 0.591 0027 | 0.591 0011 | 0.257 7641 | 0.256 1913 |
| | 4 | 0.742 4634 | 0.743 0112 | 0.602 8648 | 0.602 8633 | 0.262 8827 | 0.261 3341 |
| | 5 | 0.730 6592 | 0.731 2176 | 0.614 5433 | 0.614 5417 | 0.267 9213 | 0.266 3974 |
| | 6 | -0.718 6320 | -0.719 2007 | -0.626 0340 | -0.626 0324 | -0.272 8781 | -0.271 3794 |
| | 7 | 0.706 3855 | 0.706 9644 | 0.637 3331 | 0.637 3315 | 0.277 7514 | 0.276 2783 |
| | 8 | 0.693 9238 | 0.694 5127 | 0.648 4369 | 0.648 4352 | 0.282 5395 | 0.281 0925 |
| | 9 | 0.681 2510 | 0.681 8498 | 0.659 3417 | 0.659 3401 | 0.287 2409 | 0.285 8204 |
| | 10 | 0.668 3713 | 0.668 9797 | 0.670 0443 | 0.670 0426 | 0.291 8540 | 0.290 4605 |
| | 11 | 0.655 2888 | 0.655 9067 | 0.680 5414 | 0.680 5397 | 0.296 3775 | 0.295 0113 |
| | 12 | -0.642 0077 | -0.642 6349 | -0.690 8300 | -0.690 8283 | -0.300 8100 | -0.299 4716 |
| | 13 | 0.628 5321 | 0.629 1684 | 0.700 9070 | 0.700 9052 | 0.305 1502 | 0.303 8400 |
| | 14 | 0.614 8661 | 0.615 5114 | 0.710 7695 | 0.710 7677 | 0.309 3969 | 0.308 1153 |
| | 15 | 0.601 0139 | 0.601 6678 | 0.720 4147 | 0.720 4130 | 0.313 5489 | 0.312 2962 |
| | 16 | -0.586 9795 | -0.587 6420 | -0.729 8398 | -0.729 8381 | -0.317 6049 | -0.316 3816 |

**SUN, 2021**

EQUATORIAL RECTANGULAR CO-ORDINATES FOR $0^h$ TERRESTRIAL TIME
MEAN EQUATOR AND EQUINOX OF J 2021.5 AND J 2000.0

| Date | | $X_{2021.5}$ | $X_{2000.0}$ | $Y_{2021.5}$ | $Y_{2000.0}$ | $Z_{2021.5}$ | $Z_{2000.0}$ |
|---|---|---|---|---|---|---|---|
| Nov. | 16 | -0.586 9795 | -0.587 6420 | -0.729 8398 | -0.729 8381 | -0.317 6049 | -0.316 3816 |
| | 17 | 0.572 7670 | 0.573 4378 | 0.739 0422 | 0.739 0404 | 0.321 5639 | 0.320 3703 |
| | 18 | 0.558 3805 | 0.559 0594 | 0.748 0189 | 0.748 0171 | 0.325 4246 | 0.324 2611 |
| | 19 | 0.543 8242 | 0.544 5109 | 0.756 7675 | 0.756 7656 | 0.329 1860 | 0.328 0530 |
| | 20 | 0.529 1020 | 0.529 7964 | 0.765 2851 | 0.765 2833 | 0.332 8469 | 0.331 7447 |
| | 21 | 0.514 2182 | 0.514 9201 | 0.773 5693 | 0.773 5675 | 0.336 4063 | 0.335 3353 |
| | 22 | -0.499 1769 | -0.499 8861 | -0.781 6174 | -0.781 6155 | -0.339 8631 | -0.338 8235 |
| | 23 | 0.483 9824 | 0.484 6986 | 0.789 4268 | 0.789 4249 | 0.343 2162 | 0.342 2083 |
| | 24 | 0.468 6390 | 0.469 3620 | 0.796 9949 | 0.796 9931 | 0.346 4644 | 0.345 4886 |
| | 25 | 0.453 1509 | 0.453 8805 | 0.804 3193 | 0.804 3174 | 0.349 6068 | 0.348 6634 |
| | 26 | 0.437 5226 | 0.438 2586 | 0.811 3974 | 0.811 3955 | 0.352 6423 | 0.351 7315 |
| | 27 | 0.421 7585 | 0.422 5007 | 0.818 2266 | 0.818 2247 | 0.355 5697 | 0.354 6920 |
| | 28 | -0.405 8632 | -0.406 6113 | -0.824 8046 | -0.824 8027 | -0.358 3882 | -0.357 5437 |
| | 29 | 0.389 8413 | 0.390 5951 | 0.831 1290 | 0.831 1270 | 0.361 0966 | 0.360 2855 |
| | 30 | 0.373 6976 | 0.374 4568 | 0.837 1972 | 0.837 1952 | 0.363 6938 | 0.362 9165 |
| Dec. | 1 | 0.357 4369 | 0.358 2013 | 0.843 0069 | 0.843 0049 | 0.366 1789 | 0.365 4356 |
| | 2 | 0.341 0642 | 0.341 8337 | 0.848 5558 | 0.848 5539 | 0.368 5509 | 0.367 8418 |
| | 3 | 0.324 5848 | 0.325 3590 | 0.853 8418 | 0.853 8398 | 0.370 8087 | 0.370 1341 |
| | 4 | -0.308 0040 | -0.308 7827 | -0.858 8626 | -0.858 8607 | -0.372 9514 | -0.372 3114 |
| | 5 | 0.291 3273 | 0.292 1103 | 0.863 6165 | 0.863 6146 | 0.374 9781 | 0.374 3730 |
| | 6 | 0.274 5602 | 0.275 3473 | 0.868 1018 | 0.868 0998 | 0.376 8881 | 0.376 3181 |
| | 7 | 0.257 7086 | 0.258 4994 | 0.872 3169 | 0.872 3149 | 0.378 6808 | 0.378 1460 |
| | 8 | 0.240 7779 | 0.241 5722 | 0.876 2606 | 0.876 2586 | 0.380 3555 | 0.379 8560 |
| | 9 | 0.223 7737 | 0.224 5713 | 0.879 9318 | 0.879 9298 | 0.381 9117 | 0.381 4478 |
| | 10 | -0.206 7016 | -0.207 5023 | -0.883 3296 | -0.883 3277 | -0.383 3491 | -0.382 9209 |
| | 11 | 0.189 5670 | 0.190 3705 | 0.886 4532 | 0.886 4513 | 0.384 6674 | 0.384 2750 |
| | 12 | 0.172 3752 | 0.173 1813 | 0.889 3019 | 0.889 2999 | 0.385 8662 | 0.385 5097 |
| | 13 | 0.155 1316 | 0.155 9399 | 0.891 8749 | 0.891 8730 | 0.386 9452 | 0.386 6248 |
| | 14 | 0.137 8414 | 0.138 6518 | 0.894 1718 | 0.894 1698 | 0.387 9043 | 0.387 6200 |
| | 15 | 0.120 5098 | 0.121 3220 | 0.896 1918 | 0.896 1898 | 0.388 7433 | 0.388 4952 |
| | 16 | -0.103 1420 | -0.103 9557 | -0.897 9347 | -0.897 9327 | -0.389 4619 | -0.389 2501 |
| | 17 | 0.085 7432 | 0.086 5582 | 0.899 3998 | 0.899 3978 | 0.390 0601 | 0.389 8846 |
| | 18 | 0.068 3184 | 0.069 1344 | 0.900 5869 | 0.900 5849 | 0.390 5377 | 0.390 3986 |
| | 19 | 0.050 8729 | 0.051 6897 | 0.901 4955 | 0.901 4935 | 0.390 8945 | 0.390 7919 |
| | 20 | 0.033 4116 | 0.034 2290 | 0.902 1254 | 0.902 1234 | 0.391 1306 | 0.391 0645 |
| | 21 | -0.015 9399 | -0.016 7575 | 0.902 4763 | 0.902 4743 | 0.391 2458 | 0.391 2161 |
| | 22 | +0.001 5374 | +0.000 7197 | -0.902 5480 | -0.902 5460 | -0.391 2400 | -0.391 2469 |
| | 23 | 0.019 0149 | 0.018 1975 | 0.902 3402 | 0.902 3382 | 0.391 1132 | 0.391 1566 |
| | 24 | 0.036 4875 | 0.035 6706 | 0.901 8528 | 0.901 8509 | 0.390 8654 | 0.390 9453 |
| | 25 | 0.053 9501 | 0.053 1339 | 0.901 0858 | 0.901 0838 | 0.390 4965 | 0.390 6129 |
| | 26 | 0.071 3974 | 0.070 5822 | 0.900 0389 | 0.900 0370 | 0.390 0065 | 0.390 1594 |
| | 27 | 0.088 8240 | 0.088 0101 | 0.898 7123 | 0.898 7104 | 0.389 3955 | 0.389 5847 |
| | 28 | +0.106 2247 | +0.105 4122 | -0.897 1059 | -0.897 1040 | -0.388 6633 | -0.388 8889 |
| | 29 | 0.123 5940 | 0.122 7833 | 0.895 2200 | 0.895 2181 | 0.387 8102 | 0.388 0720 |
| | 30 | 0.140 9263 | 0.140 1176 | 0.893 0546 | 0.893 0527 | 0.386 8361 | 0.387 1341 |
| | 31 | 0.158 2161 | 0.157 4096 | 0.890 6100 | 0.890 6082 | 0.385 7411 | 0.386 0752 |
| | 32 | +0.175 4575 | +0.174 6536 | -0.887 8869 | -0.887 8850 | -0.384 5254 | -0.384 8956 |

**SUN, 2021**
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR $0^h$ TERRESTRIAL TIME

| Date | | Position Angle of Axis $P$ | Heliographic Latitude $B_0$ | Heliographic Longitude $L_0$ | Date | | Position Angle of Axis $P$ | Heliographic Latitude $B_0$ | Heliographic Longitude $L_0$ |
|---|---|---|---|---|---|---|---|---|---|
| | | ° | ° | ° | | | ° | ° | ° |
| Jan. | 0 | +2.44 | -2.91 | 293.29 | Feb. | 15 | -17.45 | -6.83 | 47.58 |
| | 1 | 1.95 | 3.03 | 280.12 | | 16 | 17.78 | 6.88 | 34.42 |
| | 2 | 1.47 | 3.15 | 266.95 | | 17 | 18.10 | 6.92 | 21.25 |
| | 3 | 0.98 | 3.26 | 253.77 | | 18 | 18.42 | 6.95 | 8.08 |
| | 4 | 0.50 | 3.38 | 240.60 | | 19 | 18.74 | 6.99 | 354.91 |
| | 5 | +0.02 | 3.49 | 227.43 | | 20 | 19.05 | 7.02 | 341.74 |
| | 6 | -0.47 | -3.60 | 214.27 | | 21 | -19.35 | -7.05 | 328.57 |
| | 7 | 0.95 | 3.71 | 201.10 | | 22 | 19.65 | 7.08 | 315.40 |
| | 8 | 1.43 | 3.82 | 187.93 | | 23 | 19.94 | 7.11 | 302.23 |
| | 9 | 1.91 | 3.93 | 174.76 | | 24 | 20.22 | 7.13 | 289.06 |
| | 10 | 2.39 | 4.04 | 161.59 | | 25 | 20.50 | 7.15 | 275.89 |
| | 11 | 2.87 | 4.15 | 148.42 | | 26 | 20.77 | 7.17 | 262.72 |
| | 12 | -3.34 | -4.25 | 135.25 | | 27 | -21.04 | -7.19 | 249.55 |
| | 13 | 3.82 | 4.36 | 122.09 | | 28 | 21.30 | 7.21 | 236.38 |
| | 14 | 4.29 | 4.46 | 108.92 | Mar. | 1 | 21.55 | 7.22 | 223.20 |
| | 15 | 4.76 | 4.56 | 95.75 | | 2 | 21.80 | 7.23 | 210.03 |
| | 16 | 5.22 | 4.66 | 82.59 | | 3 | 22.04 | 7.24 | 196.86 |
| | 17 | 5.69 | 4.76 | 69.42 | | 4 | 22.28 | 7.25 | 183.68 |
| | 18 | -6.15 | -4.85 | 56.25 | | 5 | -22.51 | -7.25 | 170.51 |
| | 19 | 6.61 | 4.95 | 43.08 | | 6 | 22.73 | 7.25 | 157.33 |
| | 20 | 7.06 | 5.04 | 29.92 | | 7 | 22.94 | 7.25 | 144.16 |
| | 21 | 7.52 | 5.13 | 16.75 | | 8 | 23.15 | 7.25 | 130.98 |
| | 22 | 7.96 | 5.22 | 3.58 | | 9 | 23.36 | 7.24 | 117.81 |
| | 23 | 8.41 | 5.31 | 350.42 | | 10 | 23.55 | 7.24 | 104.63 |
| | 24 | -8.85 | -5.40 | 337.25 | | 11 | -23.74 | -7.23 | 91.45 |
| | 25 | 9.29 | 5.48 | 324.08 | | 12 | 23.93 | 7.22 | 78.28 |
| | 26 | 9.72 | 5.57 | 310.92 | | 13 | 24.10 | 7.20 | 65.10 |
| | 27 | 10.15 | 5.65 | 297.75 | | 14 | 24.27 | 7.19 | 51.92 |
| | 28 | 10.58 | 5.73 | 284.58 | | 15 | 24.43 | 7.17 | 38.74 |
| | 29 | 11.00 | 5.81 | 271.42 | | 16 | 24.59 | 7.15 | 25.56 |
| | 30 | -11.42 | -5.88 | 258.25 | | 17 | -24.74 | -7.13 | 12.38 |
| | 31 | 11.83 | 5.96 | 245.08 | | 18 | 24.88 | 7.10 | 359.20 |
| Feb. | 1 | 12.24 | 6.03 | 231.92 | | 19 | 25.02 | 7.08 | 346.01 |
| | 2 | 12.64 | 6.10 | 218.75 | | 20 | 25.15 | 7.05 | 332.83 |
| | 3 | 13.04 | 6.17 | 205.58 | | 21 | 25.27 | 7.02 | 319.65 |
| | 4 | 13.44 | 6.23 | 192.42 | | 22 | 25.38 | 6.99 | 306.46 |
| | 5 | -13.83 | -6.30 | 179.25 | | 23 | -25.49 | -6.95 | 293.28 |
| | 6 | 14.21 | 6.36 | 166.09 | | 24 | 25.59 | 6.91 | 280.09 |
| | 7 | 14.59 | 6.42 | 152.92 | | 25 | 25.69 | 6.87 | 266.90 |
| | 8 | 14.97 | 6.48 | 139.75 | | 26 | 25.77 | 6.83 | 253.72 |
| | 9 | 15.34 | 6.54 | 126.59 | | 27 | 25.85 | 6.79 | 240.53 |
| | 10 | 15.70 | 6.59 | 113.42 | | 28 | 25.93 | 6.75 | 227.34 |
| | 11 | -16.06 | -6.64 | 100.25 | | 29 | -25.99 | -6.70 | 214.15 |
| | 12 | 16.42 | 6.70 | 87.09 | | 30 | 26.05 | 6.65 | 200.96 |
| | 13 | 16.77 | 6.74 | 73.92 | | 31 | 26.10 | 6.60 | 187.77 |
| | 14 | 17.11 | 6.79 | 60.75 | Apr. | 1 | 26.15 | 6.55 | 174.57 |
| | 15 | -17.45 | -6.83 | 47.58 | | 2 | -26.18 | -6.49 | 161.38 |

**SUN, 2021**
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR $0^h$ TERRESTRIAL TIME

| Date | Position Angle of Axis $P$ | Heliographic Latitude $B_0$ | Heliographic Longitude $L_0$ | Date | Position Angle of Axis $P$ | Heliographic Latitude $B_0$ | Heliographic Longitude $L_0$ |
|---|---|---|---|---|---|---|---|
| | ° | ° | ° | | ° | ° | ° |
| Apr. 1 | -26.15 | -6.55 | 174.57 | May 17 | -20.34 | -2.44 | 286.90 |
| 2 | 26.18 | 6.49 | 161.38 | 18 | 20.05 | 2.33 | 273.67 |
| 3 | 26.21 | 6.43 | 148.19 | 19 | 19.76 | 2.21 | 260.44 |
| 4 | 26.24 | 6.37 | 134.99 | 20 | 19.45 | 2.09 | 247.21 |
| 5 | 26.25 | 6.31 | 121.80 | 21 | 19.14 | 1.98 | 233.99 |
| 6 | 26.26 | 6.25 | 108.60 | 22 | 18.83 | 1.86 | 220.76 |
| 7 | -26.26 | -6.19 | 95.41 | 23 | -18.50 | -1.74 | 207.53 |
| 8 | 26.26 | 6.12 | 82.21 | 24 | 18.18 | 1.62 | 194.30 |
| 9 | 26.24 | 6.05 | 69.01 | 25 | 17.84 | 1.51 | 181.07 |
| 10 | 26.22 | 5.98 | 55.81 | 26 | 17.50 | 1.39 | 167.83 |
| 11 | 26.19 | 5.91 | 42.61 | 27 | 17.16 | 1.27 | 154.60 |
| 12 | 26.16 | 5.84 | 29.41 | 28 | 16.81 | 1.15 | 141.37 |
| 13 | -26.12 | -5.77 | 16.21 | 29 | -16.45 | -1.03 | 128.14 |
| 14 | 26.06 | 5.69 | 3.01 | 30 | 16.09 | 0.91 | 114.90 |
| 15 | 26.01 | 5.61 | 349.80 | 31 | 15.73 | 0.79 | 101.67 |
| 16 | 25.94 | 5.53 | 336.60 | June 1 | 15.36 | 0.67 | 88.44 |
| 17 | 25.87 | 5.45 | 323.40 | 2 | 14.98 | 0.55 | 75.20 |
| 18 | 25.79 | 5.37 | 310.19 | 3 | 14.60 | 0.43 | 61.97 |
| 19 | -25.70 | -5.29 | 296.98 | 4 | -14.22 | -0.31 | 48.74 |
| 20 | 25.61 | 5.20 | 283.78 | 5 | 13.83 | 0.19 | 35.50 |
| 21 | 25.51 | 5.11 | 270.57 | 6 | 13.43 | -0.06 | 22.27 |
| 22 | 25.40 | 5.03 | 257.36 | 7 | 13.03 | +0.06 | 9.03 |
| 23 | 25.28 | 4.94 | 244.15 | 8 | 12.63 | 0.18 | 355.80 |
| 24 | 25.16 | 4.84 | 230.94 | 9 | 12.23 | 0.30 | 342.56 |
| 25 | -25.03 | -4.75 | 217.73 | 10 | -11.82 | +0.42 | 329.33 |
| 26 | 24.89 | 4.66 | 204.52 | 11 | 11.40 | 0.54 | 316.09 |
| 27 | 24.75 | 4.56 | 191.30 | 12 | 10.99 | 0.66 | 302.85 |
| 28 | 24.59 | 4.47 | 178.09 | 13 | 10.56 | 0.78 | 289.62 |
| 29 | 24.43 | 4.37 | 164.87 | 14 | 10.14 | 0.90 | 276.38 |
| 30 | 24.27 | 4.27 | 151.66 | 15 | 9.71 | 1.02 | 263.15 |
| May 1 | -24.09 | -4.17 | 138.44 | 16 | -9.29 | +1.14 | 249.91 |
| 2 | 23.91 | 4.07 | 125.22 | 17 | 8.85 | 1.26 | 236.67 |
| 3 | 23.72 | 3.97 | 112.01 | 18 | 8.42 | 1.38 | 223.44 |
| 4 | 23.52 | 3.87 | 98.79 | 19 | 7.98 | 1.49 | 210.20 |
| 5 | 23.32 | 3.76 | 85.57 | 20 | 7.54 | 1.61 | 196.96 |
| 6 | 23.11 | 3.66 | 72.35 | 21 | 7.10 | 1.73 | 183.72 |
| 7 | -22.89 | -3.55 | 59.13 | 22 | -6.66 | +1.85 | 170.49 |
| 8 | 22.67 | 3.44 | 45.91 | 23 | 6.21 | 1.96 | 157.25 |
| 9 | 22.44 | 3.33 | 32.69 | 24 | 5.77 | 2.08 | 144.01 |
| 10 | 22.20 | 3.23 | 19.47 | 25 | 5.32 | 2.19 | 130.78 |
| 11 | 21.95 | 3.12 | 6.24 | 26 | 4.87 | 2.31 | 117.54 |
| 12 | 21.70 | 3.00 | 353.02 | 27 | 4.42 | 2.42 | 104.30 |
| 13 | -21.44 | -2.89 | 339.80 | 28 | -3.97 | +2.53 | 91.06 |
| 14 | 21.18 | 2.78 | 326.57 | 29 | 3.52 | 2.65 | 77.83 |
| 15 | 20.91 | 2.67 | 313.35 | 30 | 3.06 | 2.76 | 64.59 |
| 16 | 20.63 | 2.55 | 300.12 | July 1 | 2.61 | 2.87 | 51.35 |
| 17 | -20.34 | -2.44 | 286.90 | 2 | -2.16 | +2.98 | 38.12 |

**SUN, 2021**
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR $0^h$ TERRESTRIAL TIME

| Date | | Position Angle of Axis $P$ | Heliographic Latitude $B_0$ | Heliographic Longitude $L_0$ | Date | | Position Angle of Axis $P$ | Heliographic Latitude $B_0$ | Heliographic Longitude $L_0$ |
|---|---|---|---|---|---|---|---|---|---|
| | | ° | ° | ° | | | ° | ° | ° |
| July | 1 | -2.61 | +2.87 | 51.35 | Aug. | 16 | +16.37 | +6.69 | 162.84 |
| | 2 | 2.16 | 2.98 | 38.12 | | 17 | 16.71 | 6.74 | 149.62 |
| | 3 | 1.71 | 3.09 | 24.88 | | 18 | 17.03 | 6.78 | 136.41 |
| | 4 | 1.25 | 3.20 | 11.65 | | 19 | 17.36 | 6.82 | 123.19 |
| | 5 | 0.80 | 3.30 | 358.41 | | 20 | 17.67 | 6.86 | 109.97 |
| | 6 | -0.35 | 3.41 | 345.18 | | 21 | 17.99 | 6.90 | 96.76 |
| | 7 | +0.11 | +3.52 | 331.94 | | 22 | +18.29 | +6.94 | 83.54 |
| | 8 | 0.56 | 3.62 | 318.71 | | 23 | 18.60 | 6.97 | 70.33 |
| | 9 | 1.01 | 3.73 | 305.47 | | 24 | 18.89 | 7.00 | 57.11 |
| | 10 | 1.46 | 3.83 | 292.24 | | 25 | 19.19 | 7.04 | 43.90 |
| | 11 | 1.91 | 3.93 | 279.00 | | 26 | 19.47 | 7.06 | 30.69 |
| | 12 | 2.36 | 4.03 | 265.77 | | 27 | 19.75 | 7.09 | 17.47 |
| | 13 | +2.80 | +4.13 | 252.54 | | 28 | +20.03 | +7.12 | 4.26 |
| | 14 | 3.25 | 4.23 | 239.30 | | 29 | 20.30 | 7.14 | 351.05 |
| | 15 | 3.69 | 4.33 | 226.07 | | 30 | 20.57 | 7.16 | 337.84 |
| | 16 | 4.14 | 4.42 | 212.84 | | 31 | 20.83 | 7.18 | 324.63 |
| | 17 | 4.58 | 4.52 | 199.61 | Sept. | 1 | 21.09 | 7.19 | 311.42 |
| | 18 | 5.01 | 4.61 | 186.37 | | 2 | 21.34 | 7.21 | 298.21 |
| | 19 | +5.45 | +4.71 | 173.14 | | 3 | +21.58 | +7.22 | 285.00 |
| | 20 | 5.88 | 4.80 | 159.91 | | 4 | 21.82 | 7.23 | 271.79 |
| | 21 | 6.31 | 4.89 | 146.68 | | 5 | 22.05 | 7.24 | 258.59 |
| | 22 | 6.74 | 4.97 | 133.45 | | 6 | 22.28 | 7.25 | 245.38 |
| | 23 | 7.17 | 5.06 | 120.22 | | 7 | 22.50 | 7.25 | 232.17 |
| | 24 | 7.59 | 5.15 | 106.99 | | 8 | 22.72 | 7.25 | 218.97 |
| | 25 | +8.01 | +5.23 | 93.76 | | 9 | +22.92 | +7.25 | 205.76 |
| | 26 | 8.43 | 5.32 | 80.53 | | 10 | 23.13 | 7.25 | 192.56 |
| | 27 | 8.84 | 5.40 | 67.30 | | 11 | 23.33 | 7.25 | 179.35 |
| | 28 | 9.26 | 5.48 | 54.07 | | 12 | 23.52 | 7.24 | 166.15 |
| | 29 | 9.67 | 5.56 | 40.85 | | 13 | 23.70 | 7.23 | 152.95 |
| | 30 | 10.07 | 5.63 | 27.62 | | 14 | 23.88 | 7.22 | 139.74 |
| | 31 | +10.47 | +5.71 | 14.39 | | 15 | +24.06 | +7.21 | 126.54 |
| Aug. | 1 | 10.87 | 5.78 | 1.17 | | 16 | 24.22 | 7.19 | 113.34 |
| | 2 | 11.27 | 5.85 | 347.94 | | 17 | 24.39 | 7.18 | 100.14 |
| | 3 | 11.66 | 5.92 | 334.72 | | 18 | 24.54 | 7.16 | 86.93 |
| | 4 | 12.04 | 5.99 | 321.49 | | 19 | 24.69 | 7.14 | 73.73 |
| | 5 | 12.43 | 6.06 | 308.27 | | 20 | 24.83 | 7.11 | 60.53 |
| | 6 | +12.81 | +6.13 | 295.04 | | 21 | +24.97 | +7.09 | 47.33 |
| | 7 | 13.18 | 6.19 | 281.82 | | 22 | 25.10 | 7.06 | 34.13 |
| | 8 | 13.55 | 6.25 | 268.60 | | 23 | 25.22 | 7.03 | 20.93 |
| | 9 | 13.92 | 6.31 | 255.38 | | 24 | 25.33 | 7.00 | 7.73 |
| | 10 | 14.29 | 6.37 | 242.16 | | 25 | 25.44 | 6.97 | 354.54 |
| | 11 | 14.64 | 6.43 | 228.94 | | 26 | 25.55 | 6.93 | 341.34 |
| | 12 | +15.00 | +6.49 | 215.72 | | 27 | +25.64 | +6.89 | 328.14 |
| | 13 | 15.35 | 6.54 | 202.50 | | 28 | 25.73 | 6.85 | 314.94 |
| | 14 | 15.70 | 6.59 | 189.28 | | 29 | 25.81 | 6.81 | 301.75 |
| | 15 | 16.04 | 6.64 | 176.06 | | 30 | 25.89 | 6.77 | 288.55 |
| | 16 | +16.37 | +6.69 | 162.84 | Oct. | 1 | +25.96 | +6.72 | 275.35 |

**SUN, 2021**
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR $0^h$ TERRESTRIAL TIME

| Date | Position Angle of Axis | Heliographic Latitude | Heliographic Longitude | Date | Position Angle of Axis | Heliographic Latitude | Heliographic Longitude |
|---|---|---|---|---|---|---|---|
| | $P$ | $B_0$ | $L_0$ | | $P$ | $B_0$ | $L_0$ |
| | ° | ° | ° | | ° | ° | ° |
| Oct. 1 | +25.96 | +6.72 | 275.35 | Nov. 16 | +21.06 | +2.73 | 28.68 |
| 2 | 26.02 | 6.67 | 262.16 | 17 | 20.78 | 2.62 | 15.49 |
| 3 | 26.08 | 6.62 | 248.96 | 18 | 20.48 | 2.50 | 2.31 |
| 4 | 26.12 | 6.57 | 235.77 | 19 | 20.18 | 2.38 | 349.13 |
| 5 | 26.16 | 6.52 | 222.58 | 20 | 19.87 | 2.26 | 335.95 |
| 6 | 26.20 | 6.46 | 209.38 | 21 | 19.56 | 2.13 | 322.76 |
| 7 | +26.23 | +6.41 | 196.19 | 22 | +19.23 | +2.01 | 309.58 |
| 8 | 26.24 | 6.35 | 182.99 | 23 | 18.90 | 1.89 | 296.40 |
| 9 | 26.26 | 6.28 | 169.80 | 24 | 18.57 | 1.77 | 283.22 |
| 10 | 26.26 | 6.22 | 156.61 | 25 | 18.22 | 1.64 | 270.04 |
| 11 | 26.26 | 6.16 | 143.42 | 26 | 17.87 | 1.52 | 256.86 |
| 12 | 26.25 | 6.09 | 130.23 | 27 | 17.52 | 1.39 | 243.68 |
| 13 | +26.23 | +6.02 | 117.03 | 28 | +17.15 | +1.27 | 230.50 |
| 14 | 26.21 | 5.95 | 103.84 | 29 | 16.78 | 1.14 | 217.32 |
| 15 | 26.17 | 5.88 | 90.65 | 30 | 16.41 | 1.01 | 204.14 |
| 16 | 26.13 | 5.80 | 77.46 | Dec. 1 | 16.03 | 0.89 | 190.96 |
| 17 | 26.09 | 5.72 | 64.27 | 2 | 15.64 | 0.76 | 177.78 |
| 18 | 26.03 | 5.65 | 51.08 | 3 | 15.24 | 0.63 | 164.61 |
| 19 | +25.97 | +5.57 | 37.89 | 4 | +14.84 | +0.50 | 151.43 |
| 20 | 25.90 | 5.49 | 24.70 | 5 | 14.44 | 0.38 | 138.25 |
| 21 | 25.82 | 5.40 | 11.51 | 6 | 14.03 | 0.25 | 125.07 |
| 22 | 25.74 | 5.32 | 358.32 | 7 | 13.61 | +0.12 | 111.90 |
| 23 | 25.64 | 5.23 | 345.13 | 8 | 13.19 | -0.01 | 98.72 |
| 24 | 25.54 | 5.14 | 331.94 | 9 | 12.77 | 0.14 | 85.54 |
| 25 | +25.43 | +5.05 | 318.75 | 10 | +12.34 | -0.26 | 72.37 |
| 26 | 25.32 | 4.96 | 305.56 | 11 | 11.90 | 0.39 | 59.19 |
| 27 | 25.19 | 4.87 | 292.38 | 12 | 11.46 | 0.52 | 46.01 |
| 28 | 25.06 | 4.78 | 279.19 | 13 | 11.02 | 0.65 | 32.84 |
| 29 | 24.92 | 4.68 | 266.00 | 14 | 10.57 | 0.78 | 19.66 |
| 30 | 24.77 | 4.58 | 252.81 | 15 | 10.12 | 0.90 | 6.49 |
| 31 | +24.62 | +4.48 | 239.63 | 16 | +9.67 | -1.03 | 353.31 |
| Nov. 1 | 24.45 | 4.38 | 226.44 | 17 | 9.21 | 1.16 | 340.14 |
| 2 | 24.28 | 4.28 | 213.26 | 18 | 8.75 | 1.28 | 326.96 |
| 3 | 24.10 | 4.18 | 200.07 | 19 | 8.29 | 1.41 | 313.79 |
| 4 | 23.91 | 4.07 | 186.88 | 20 | 7.82 | 1.54 | 300.61 |
| 5 | 23.72 | 3.97 | 173.70 | 21 | 7.35 | 1.66 | 287.44 |
| 6 | +23.52 | +3.86 | 160.51 | 22 | +6.88 | -1.79 | 274.26 |
| 7 | 23.31 | 3.75 | 147.33 | 23 | 6.40 | 1.91 | 261.09 |
| 8 | 23.09 | 3.65 | 134.15 | 24 | 5.93 | 2.03 | 247.92 |
| 9 | 22.86 | 3.54 | 120.96 | 25 | 5.45 | 2.16 | 234.75 |
| 10 | 22.63 | 3.42 | 107.78 | 26 | 4.97 | 2.28 | 221.57 |
| 11 | 22.39 | 3.31 | 94.59 | 27 | 4.49 | 2.40 | 208.40 |
| 12 | +22.14 | +3.20 | 81.41 | 28 | +4.01 | -2.52 | 195.23 |
| 13 | 21.88 | 3.08 | 68.23 | 29 | 3.53 | 2.64 | 182.06 |
| 14 | 21.62 | 2.97 | 55.04 | 30 | 3.04 | 2.76 | 168.89 |
| 15 | 21.34 | 2.85 | 41.86 | 31 | 2.56 | 2.88 | 155.72 |
| 16 | +21.06 | +2.73 | 28.68 | 32 | +2.07 | -3.00 | 142.55 |

## MOON, 2021

UNIVERSAL TIME

### PHASES OF THE MOON

| Lunation | New Moon | d | h | m | First Quarter | d | h | m | Full Moon | d | h | m | Last Quarter | d | h | m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1214 | Jan. | 13 | 05 | 00 | Jan. | 20 | 21 | 02 | Jan. | 28 | 19 | 16 | Feb. | 4 | 17 | 37 |
| 1215 | Feb. | 11 | 19 | 06 | Feb. | 19 | 18 | 47 | Feb. | 27 | 08 | 17 | Mar. | 6 | 01 | 30 |
| 1216 | Mar. | 13 | 10 | 21 | Mar. | 21 | 14 | 40 | Mar. | 28 | 18 | 48 | April | 4 | 10 | 02 |
| 1217 | April | 12 | 02 | 31 | Apr. | 20 | 06 | 59 | Apr. | 27 | 03 | 31 | May | 3 | 19 | 50 |
| 1218 | May | 11 | 19 | 00 | May | 19 | 19 | 13 | May | 26 | 11 | 14 | June | 2 | 07 | 24 |
| 1219 | Jun. | 10 | 10 | 53 | Jun. | 18 | 03 | 54 | Jun. | 24 | 18 | 40 | Jul. | 1 | 21 | 11 |
| 1220 | Jul. | 10 | 01 | 17 | Jun. | 17 | 10 | 11 | Jul. | 24 | 02 | 37 | Jul. | 31 | 13 | 16 |
| 1221 | Aug. | 08 | 13 | 50 | Aug. | 15 | 15 | 20 | Aug. | 22 | 12 | 02 | Aug. | 30 | 07 | 13 |
| 1222 | Sep. | 7 | 0 | 52 | Sep. | 13 | 20 | 39 | Sep. | 20 | 23 | 55 | Sep. | 29 | 01 | 57 |
| 1223 | Oct. | 6 | 11 | 05 | Oct. | 13 | 03 | 25 | Oct. | 20 | 14 | 57 | Oct. | 28 | 20 | 05 |
| 1224 | Nov. | 4 | 21 | 15 | Nov. | 11 | 12 | 46 | Nov. | 19 | 08 | 57 | Nov. | 27 | 12 | 28 |
| 1225 | Dec. | 4 | 07 | 43 | Dec. | 11 | 01 | 36 | Dec. | 19 | 04 | 35 | Dec. | 27 | 02 | 24 |
| 1226 | Jan. | 2 | 18 | 33 | Jan. | 9 | 18 | 11 | Jan. | 17 | 23 | 48 | Jan. | 25 | 13 | 41 |

### MOON AT PERIGEE

| | d | h | | d | h | | d | h |
|---|---|---|---|---|---|---|---|---|
| Dec. | 12 | 21 | Apr. | 27 | 15 | Sept. | 11 | 10 |
| Jan. | 9 | 16 | May | 26 | 02 | Oct. | 8 | 17 |
| Feb. | 3 | 19 | Jun. | 23 | 10 | Nov. | 5 | 22 |
| Mar. | 2 | 05 | Jul. | 21 | 10 | Dec | 4 | 10 |
| Mar. | 30 | 06 | Aug. | 17 | 09 | Jan. | 1 | 23 |

### MOON AT APOGEE

| | d | h | | d | h | | d | h |
|---|---|---|---|---|---|---|---|---|
| Dec. | 24 | 17 | May | 11 | 22 | Sep. | 26 | 22 |
| Jan. | 21 | 13 | Jun. | 8 | 02 | Oct. | 24 | 15 |
| Feb. | 18 | 10 | Jul. | 5 | 15 | Nov. | 21 | 02 |
| Mar. | 18 | 05 | Aug. | 2 | 08 | Dec. | 18 | 02 |
| Apr. | 14 | 18 | Aug. | 30 | 02 | Jan. | 14 | 09 |

## MOON, 2021
## MEAN EQUATOR, ORBIT, LONGITUDE AND ELONGATION

| Date | | Mean Equator | | | Orbit Perigee | | | Node | | | Mean Longitude | | | Mean Elongation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $i$ | Δ | Ω' | Γ' | | | Ω | | | ☾ | | | D |
| | | ° | ° | ° | ° | ' | " | ° | ' | " | ° | ' | " | ° |
| Jan. | 1 | 23.185 | 262.391 | 356.153 | 217 | 52 | 24.6 | 78 | 51 | 46.1 | 127 | 51 | 56.6 | 206.991 |
| | 11 | 23.171 | 261.855 | 356.158 | 218 | 59 | 15.1 | 78 | 19 | 59.7 | 259 | 37 | 46.9 | 328.899 |
| | 21 | 23.156 | 261.318 | 356.163 | 220 | 06 | 05.7 | 77 | 48 | 13.4 | 31 | 23 | 37.2 | 90.806 |
| | 31 | 23.142 | 260.781 | 356.168 | 221 | 12 | 56.2 | 77 | 16 | 27.1 | 163 | 09 | 27.5 | 212.714 |
| Feb. | 10 | 23.128 | 260.243 | 356.174 | 222 | 19 | 46.7 | 76 | 44 | 40.7 | 294 | 55 | 17.7 | 334.621 |
| | 20 | 23.113 | 259.706 | 356.181 | 223 | 26 | 37.2 | 76 | 12 | 54.4 | 66 | 41 | 08.0 | 96.529 |
| Mar. | 2 | 23.099 | 259.167 | 356.187 | 224 | 33 | 27.7 | 75 | 41 | 08.0 | 198 | 26 | 58.3 | 218.436 |
| | 12 | 23.085 | 258.629 | 356.194 | 225 | 40 | 18.3 | 75 | 09 | 21.7 | 330 | 12 | 48.5 | 340.344 |
| | 22 | 23.070 | 258.091 | 356.201 | 226 | 47 | 08.8 | 74 | 37 | 35.4 | 101 | 58 | 38.8 | 102.251 |
| Apr. | 1 | 23.056 | 257.552 | 356.209 | 227 | 53 | 59.3 | 74 | 05 | 49.0 | 233 | 44 | 29.1 | 224.159 |
| | 11 | 23.042 | 257.012 | 356.216 | 229 | 00 | 49.8 | 73 | 34 | 02.7 | 5 | 30 | 19.4 | 346.066 |
| | 21 | 23.027 | 256.473 | 356.225 | 230 | 07 | 40.4 | 73 | 02 | 16.4 | 137 | 16 | 09.6 | 107.974 |
| May | 1 | 23.013 | 255.933 | 356.233 | 231 | 14 | 30.9 | 72 | 30 | 30.0 | 269 | 01 | 59.9 | 229.881 |
| | 11 | 22.999 | 255.393 | 356.242 | 232 | 21 | 21.4 | 71 | 58 | 43.7 | 40 | 47 | 50.2 | 351.789 |
| | 21 | 22.984 | 254.852 | 356.251 | 233 | 28 | 11.9 | 71 | 26 | 57.4 | 172 | 33 | 40.5 | 113.696 |
| | 31 | 22.970 | 254.312 | 356.261 | 234 | 35 | 02.5 | 70 | 55 | 11.0 | 304 | 19 | 30.7 | 235.604 |
| June | 10 | 22.956 | 253.771 | 356.270 | 235 | 41 | 53.0 | 70 | 23 | 24.7 | 76 | 05 | 21.0 | 357.511 |
| | 20 | 22.941 | 253.229 | 356.281 | 236 | 48 | 43.5 | 69 | 51 | 38.4 | 207 | 51 | 11.3 | 119.419 |
| | 30 | 22.927 | 252.688 | 356.291 | 237 | 55 | 34.0 | 69 | 19 | 52.0 | 339 | 37 | 01.5 | 241.326 |
| July | 10 | 22.913 | 252.146 | 356.302 | 239 | 02 | 24.5 | 68 | 48 | 05.7 | 111 | 22 | 51.8 | 3.234 |
| | 20 | 22.898 | 251.604 | 356.313 | 240 | 09 | 15.1 | 68 | 16 | 19.4 | 243 | 08 | 42.1 | 125.141 |
| | 30 | 22.884 | 251.061 | 356.324 | 241 | 16 | 05.6 | 67 | 44 | 33.0 | 14 | 54 | 32.4 | 247.049 |
| Aug. | 9 | 22.869 | 250.518 | 356.336 | 242 | 22 | 56.1 | 67 | 12 | 46.7 | 146 | 40 | 22.6 | 8.956 |
| | 19 | 22.855 | 249.975 | 356.348 | 243 | 29 | 46.6 | 66 | 41 | 00.4 | 278 | 26 | 12.9 | 130.864 |
| | 29 | 22.840 | 249.432 | 356.361 | 244 | 36 | 37.2 | 66 | 09 | 14.0 | 50 | 12 | 03.2 | 252.771 |
| Sept. | 8 | 22.826 | 248.888 | 356.373 | 245 | 43 | 27.7 | 65 | 37 | 27.7 | 181 | 57 | 53.4 | 14.678 |
| | 18 | 22.812 | 248.344 | 356.387 | 246 | 50 | 18.2 | 65 | 05 | 41.4 | 313 | 43 | 43.7 | 136.586 |
| | 28 | 22.797 | 247.799 | 356.400 | 247 | 57 | 08.7 | 64 | 33 | 55.0 | 85 | 29 | 34.0 | 258.493 |
| Oct. | 8 | 22.783 | 247.255 | 356.414 | 249 | 03 | 59.2 | 64 | 02 | 08.7 | 217 | 15 | 24.3 | 20.401 |
| | 18 | 22.768 | 246.710 | 356.428 | 250 | 10 | 49.8 | 63 | 30 | 22.4 | 349 | 01 | 14.5 | 142.308 |
| | 28 | 22.754 | 246.165 | 356.442 | 251 | 17 | 40.3 | 62 | 58 | 36.0 | 120 | 47 | 04.8 | 264.216 |
| Nov. | 7 | 22.739 | 245.619 | 356.457 | 252 | 24 | 30.8 | 62 | 26 | 49.7 | 252 | 32 | 55.1 | 26.123 |
| | 17 | 22.725 | 245.073 | 356.472 | 253 | 31 | 21.3 | 61 | 55 | 03.3 | 24 | 18 | 45.4 | 148.031 |
| | 27 | 22.711 | 244.527 | 356.487 | 254 | 38 | 11.9 | 61 | 23 | 17.0 | 156 | 04 | 35.6 | 269.938 |
| Dec. | 7 | 22.696 | 243.981 | 356.503 | 255 | 45 | 02.4 | 60 | 51 | 30.7 | 287 | 50 | 25.9 | 31.846 |
| | 17 | 22.682 | 243.434 | 356.519 | 256 | 51 | 52.9 | 60 | 19 | 44.3 | 59 | 36 | 16.2 | 153.753 |
| | 27 | 22.667 | 242.887 | 356.536 | 257 | 58 | 43.4 | 59 | 47 | 58.0 | 191 | 22 | 6.4 | 275.661 |
| | 37 | 22.653 | 242.340 | 356.552 | 259 | 05 | 34.0 | 59 | 16 | 11.7 | 323 | 07 | 56.7 | 37.568 |
| | 47 | 22.638 | 241.792 | 356.569 | 260 | 12 | 24.5 | 58 | 44 | 25.3 | 94 | 53 | 47.0 | 159.476 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Longitude | | | Apparent Latitude | | | True Geocentric Distance (A. U.) | Semi Diameter | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | (X $10^{-3}$) | ' | " |
| Jan. | 0.0 | 109 | 46 | 18.8 | +2 | 37 | 06.7 | 2.6060 | 15 | 19.25 |
| | 0.5 | 116 | 13 | 08.3 | 3 | 06 | 48.1 | 2.5946 | 15 | 23.27 |
| | 1.0 | 122 | 43 | 28.7 | 3 | 34 | 19.1 | 2.5834 | 15 | 27.26 |
| | 1.5 | 129 | 17 | 16.4 | 3 | 59 | 14.4 | 2.5725 | 15 | 31.21 |
| | 2.0 | 135 | 54 | 25.9 | 4 | 21 | 09.8 | 2.5618 | 15 | 35.08 |
| | 2.5 | 142 | 34 | 51.0 | 4 | 39 | 42.7 | 2.5515 | 15 | 38.87 |
| | 3.0 | 149 | 18 | 24.3 | +4 | 54 | 33.2 | 2.5414 | 15 | 42.58 |
| | 3.5 | 156 | 04 | 58.2 | 5 | 05 | 23.8 | 2.5317 | 15 | 46.20 |
| | 4.0 | 162 | 54 | 24.8 | 5 | 12 | 00.3 | 2.5223 | 15 | 49.72 |
| | 4.5 | 169 | 46 | 36.2 | 5 | 14 | 12.0 | 2.5133 | 15 | 53.14 |
| | 5.0 | 176 | 41 | 24.6 | 5 | 11 | 52.1 | 2.5046 | 15 | 56.45 |
| | 5.5 | 183 | 38 | 41.9 | 5 | 04 | 57.6 | 2.4963 | 15 | 59.63 |
| | 6.0 | 190 | 38 | 19.9 | +4 | 53 | 30.0 | 2.4885 | 16 | 02.65 |
| | 6.5 | 197 | 40 | 10.1 | 4 | 37 | 35.2 | 2.4812 | 16 | 05.48 |
| | 7.0 | 204 | 44 | 02.5 | 4 | 17 | 23.8 | 2.4745 | 16 | 08.07 |
| | 7.5 | 211 | 49 | 46.0 | 3 | 53 | 10.9 | 2.4686 | 16 | 10.38 |
| | 8.0 | 218 | 57 | 07.6 | 3 | 25 | 16.5 | 2.4637 | 16 | 12.34 |
| | 8.5 | 226 | 05 | 51.5 | 2 | 54 | 05.2 | 2.4598 | 16 | 13.87 |
| | 9.0 | 233 | 15 | 39.1 | +2 | 20 | 05.7 | 2.4571 | 16 | 14.92 |
| | 9.5 | 240 | 26 | 08.8 | 1 | 43 | 51.1 | 2.4559 | 16 | 15.41 |
| | 10.0 | 247 | 36 | 55.3 | 1 | 05 | 57.4 | 2.4562 | 16 | 15.29 |
| | 10.5 | 254 | 47 | 30.2 | 0 | 27 | 03.4 | 2.4583 | 16 | 14.48 |
| | 11.0 | 261 | 57 | 22.2 | 0 | 12 | 10.7 | 2.4621 | 16 | 12.97 |
| | 11.5 | 269 | 05 | 57.4 | +0 | 51 | 04.3 | 2.4677 | 16 | 10.73 |
| | 12.0 | 276 | 12 | 40.6 | -1 | 28 | 57.6 | 2.4753 | 16 | 07.78 |
| | 12.5 | 283 | 16 | 56.0 | 2 | 05 | 13.0 | 2.4847 | 16 | 04.13 |
| | 13.0 | 290 | 18 | 08.8 | 2 | 39 | 16.1 | 2.4958 | 15 | 59.84 |
| | 13.5 | 297 | 15 | 45.7 | 3 | 10 | 36.4 | 2.5085 | 15 | 54.98 |
| | 14.0 | 304 | 09 | 17.2 | 3 | 38 | 48.5 | 2.5225 | 15 | 49.65 |
| | 14.5 | 310 | 58 | 17.5 | 4 | 03 | 32.1 | 2.5377 | 15 | 43.96 |
| | 15.0 | 317 | 42 | 26.7 | -4 | 24 | 32.2 | 2.5538 | 15 | 38.02 |
| | 15.5 | 324 | 21 | 30.4 | 4 | 41 | 39.2 | 2.5704 | 15 | 31.96 |
| | 16.0 | 330 | 55 | 20.8 | 4 | 54 | 47.8 | 2.5873 | 15 | 25.89 |
| | 16.5 | 337 | 23 | 56.7 | 5 | 03 | 57.3 | 2.6040 | 15 | 19.94 |
| | 17.0 | 343 | 47 | 23.2 | 5 | 09 | 10.4 | 2.6203 | 15 | 14.23 |
| | 17.5 | 350 | 05 | 51.8 | 5 | 10 | 32.7 | 2.6358 | 15 | 08.84 |
| | 18.0 | 356 | 19 | 39.4 | -5 | 08 | 12.2 | 2.6502 | 15 | 03.89 |
| | 18.5 | 2 | 29 | 08.4 | 5 | 02 | 18.2 | 2.6634 | 14 | 59.44 |
| | 19.0 | 8 | 34 | 45.4 | 4 | 53 | 01.6 | 2.6749 | 14 | 55.56 |
| | 19.5 | 14 | 37 | 01.0 | 4 | 40 | 33.7 | 2.6846 | 14 | 52.31 |
| | 20.0 | 20 | 36 | 28.7 | 4 | 25 | 06.6 | 2.6924 | 14 | 49.73 |
| | 20.5 | 26 | 33 | 44.6 | 4 | 06 | 52.3 | 2.6981 | 14 | 47.85 |
| | 21.0 | 32 | 29 | 26.4 | -3 | 46 | 03.5 | 2.7016 | 14 | 46.69 |
| | 21.5 | 38 | 24 | 13.2 | 3 | 22 | 52.7 | 2.7030 | 14 | 46.26 |
| | 22.0 | 44 | 18 | 44.3 | 2 | 57 | 33.0 | 2.7021 | 14 | 46.54 |
| | 22.5 | 50 | 13 | 39.4 | 2 | 30 | 17.8 | 2.6991 | 14 | 47.54 |
| | 23.0 | 56 | 09 | 37.4 | -2 | 01 | 21.1 | 2.6940 | 14 | 49.22 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Longitude | | | Apparent Latitude | | | True Geocentric Distance (A. U.) | Semi Diameter | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | (X $10^{-3}$) | ' | " |
| Jan. | 23.0 | 56 | 09 | 37.4 | -2 | 01 | 21.1 | 2.6940 | 14 | 49.22 |
| | 23.5 | 62 | 07 | 16.1 | -1 | 30 | 58.0 | 2.6870 | 14 | 51.54 |
| | 24.0 | 68 | 07 | 11.5 | +0 | 59 | 24.2 | 2.6782 | 14 | 54.47 |
| | 24.5 | 74 | 09 | 57.4 | 0 | 26 | 57.2 | 2.6678 | 14 | 57.94 |
| | 25.0 | 80 | 16 | 04.8 | 0 | 06 | 04.4 | 2.6561 | 15 | 01.90 |
| | 25.5 | 86 | 26 | 01.1 | 0 | 39 | 20.0 | 2.6433 | 15 | 06.27 |
| | 26.0 | 92 | 40 | 09.5 | +1 | 12 | 27.6 | 2.6296 | 15 | 10.97 |
| | 26.5 | 98 | 58 | 48.6 | 1 | 45 | 03.3 | 2.6154 | 15 | 15.92 |
| | 27.0 | 105 | 22 | 11.7 | 2 | 16 | 41.6 | 2.6009 | 15 | 21.03 |
| | 27.5 | 111 | 50 | 26.4 | 2 | 46 | 55.8 | 2.5864 | 15 | 26.20 |
| | 28.0 | 118 | 23 | 34.4 | 3 | 15 | 18.4 | 2.5721 | 15 | 31.33 |
| | 28.5 | 125 | 01 | 30.9 | 3 | 41 | 21.5 | 2.5584 | 15 | 36.35 |
| | 29.0 | 131 | 44 | 05.2 | +4 | 04 | 37.7 | 2.5453 | 15 | 41.17 |
| | 29.5 | 138 | 31 | 00.9 | 4 | 24 | 40.9 | 2.5331 | 15 | 45.70 |
| | 30.0 | 145 | 21 | 56.2 | 4 | 41 | 07.0 | 2.5219 | 15 | 49.90 |
| | 30.5 | 152 | 16 | 25.0 | 4 | 53 | 35.0 | 2.5118 | 15 | 53.69 |
| | 31.0 | 159 | 13 | 58.1 | 5 | 01 | 47.8 | 2.5030 | 15 | 57.06 |
| | 31.5 | 166 | 14 | 04.2 | 5 | 05 | 32.6 | 2.4954 | 15 | 59.97 |
| Feb. | 1.0 | 173 | 16 | 11.1 | +5 | 04 | 41.8 | 2.4891 | 16 | 02.42 |
| | 1.5 | 180 | 19 | 47.4 | 4 | 59 | 12.8 | 2.4839 | 16 | 04.41 |
| | 2.0 | 187 | 24 | 23.4 | 4 | 49 | 08.7 | 2.4799 | 16 | 05.96 |
| | 2.5 | 194 | 29 | 32.1 | 4 | 34 | 37.8 | 2.4770 | 16 | 07.09 |
| | 3.0 | 201 | 34 | 49.7 | 4 | 15 | 53.3 | 2.4752 | 16 | 07.83 |
| | 3.5 | 208 | 39 | 56.5 | 3 | 53 | 13.2 | 2.4742 | 16 | 08.20 |
| | 4.0 | 215 | 44 | 36.3 | +3 | 26 | 59.4 | 2.4741 | 16 | 08.22 |
| | 4.5 | 222 | 48 | 36.6 | 2 | 57 | 37.4 | 2.4749 | 16 | 07.94 |
| | 5.0 | 229 | 51 | 47.9 | 2 | 25 | 35.7 | 2.4764 | 16 | 07.35 |
| | 5.5 | 236 | 54 | 03.0 | 1 | 51 | 25.2 | 2.4786 | 16 | 06.47 |
| | 6.0 | 243 | 55 | 16.2 | 1 | 15 | 38.7 | 2.4816 | 16 | 05.31 |
| | 6.5 | 250 | 55 | 22.2 | 0 | 38 | 50.2 | 2.4853 | 16 | 03.86 |
| | 7.0 | 257 | 54 | 15.7 | +0 | 01 | 34.3 | 2.4899 | 16 | 02.11 |
| | 7.5 | 264 | 51 | 50.2 | +0 | 35 | 34.3 | 2.4952 | 16 | 00.06 |
| | 8.0 | 271 | 47 | 57.5 | -1 | 12 | 01.2 | 2.5014 | 15 | 57.69 |
| | 8.5 | 278 | 42 | 27.4 | 1 | 47 | 13.3 | 2.5084 | 15 | 54.99 |
| | 9.0 | 285 | 35 | 07.5 | 2 | 20 | 39.3 | 2.5164 | 15 | 51.96 |
| | 9.5 | 292 | 25 | 43.0 | 2 | 51 | 50.3 | 2.5253 | 15 | 48.60 |
| | 10.0 | 299 | 13 | 57.5 | -3 | 20 | 20.4 | 2.5352 | 15 | 44.92 |
| | 10.5 | 305 | 59 | 33.4 | 3 | 45 | 47.3 | 2.5459 | 15 | 40.95 |
| | 11.0 | 312 | 42 | 12.4 | 4 | 07 | 52.4 | 2.5573 | 15 | 36.72 |
| | 11.5 | 319 | 21 | 36.9 | 4 | 26 | 21.5 | 2.5695 | 15 | 32.28 |
| | 12.0 | 325 | 57 | 30.3 | 4 | 41 | 04.5 | 2.5823 | 15 | 27.67 |
| | 12.5 | 332 | 29 | 38.6 | 4 | 51 | 55.7 | 2.5954 | 15 | 22.97 |
| | 13.0 | 338 | 57 | 50.7 | -4 | 58 | 53.2 | 2.6088 | 15 | 18.25 |
| | 13.5 | 345 | 21 | 59.7 | 5 | 01 | 58.8 | 2.6222 | 15 | 13.57 |
| | 14.0 | 351 | 42 | 02.8 | 5 | 01 | 17.6 | 2.6353 | 15 | 09.03 |
| | 14.5 | 357 | 58 | 02.4 | 4 | 56 | 57.2 | 2.6479 | 15 | 04.69 |
| | 15.0 | 4 | 10 | 05.7 | -4 | 49 | 07.6 | 2.6598 | 15 | 00.65 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Longitude | | | Apparent Latitude | | | True Geocentric Distance (A. U.) | Semi Diameter | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | (X $10^{-3}$) | ' | " |
| Feb. | 15.0 | 4 | 10 | 05.7 | -4 | 49 | 07.6 | 2.6598 | 15 | 00.65 |
| | 15.5 | 10 | 18 | 24.9 | 4 | 38 | 00.3 | 2.6707 | 14 | 56.97 |
| | 16.0 | 16 | 23 | 17.2 | 4 | 23 | 48.1 | 2.6804 | 14 | 53.73 |
| | 16.5 | 22 | 25 | 04.5 | 4 | 06 | 44.7 | 2.6886 | 14 | 50.98 |
| | 17.0 | 28 | 24 | 12.8 | 3 | 47 | 04.2 | 2.6953 | 14 | 48.79 |
| | 17.5 | 34 | 21 | 12.0 | 3 | 25 | 00.9 | 2.7001 | 14 | 47.21 |
| | 18.0 | 40 | 16 | 35.4 | -3 | 00 | 49.5 | 2.7029 | 14 | 46.28 |
| | 18.5 | 46 | 10 | 59.2 | 2 | 34 | 44.4 | 2.7037 | 14 | 46.03 |
| | 19.0 | 52 | 05 | 01.6 | 2 | 07 | 00.6 | 2.7023 | 14 | 46.47 |
| | 19.5 | 57 | 59 | 22.9 | 1 | 37 | 52.8 | 2.6988 | 14 | 47.64 |
| | 20.0 | 63 | 54 | 44.5 | -1 | 07 | 36.5 | 2.6930 | 14 | 49.52 |
| | 20.5 | 69 | 51 | 48.2 | +0 | 36 | 27.4 | 2.6852 | 14 | 52.12 |
| | 21.0 | 75 | 51 | 15.9 | +0 | 04 | 42.1 | 2.6754 | 14 | 55.40 |
| | 21.5 | 81 | 53 | 48.7 | 0 | 27 | 21.6 | 2.6636 | 14 | 59.35 |
| | 22.0 | 88 | 00 | 05.9 | 0 | 59 | 25.0 | 2.6502 | 15 | 03.90 |
| | 22.5 | 94 | 10 | 44.6 | 1 | 31 | 07.7 | 2.6353 | 15 | 09.01 |
| | 23.0 | 100 | 26 | 18.3 | 2 | 02 | 07.9 | 2.6192 | 15 | 14.60 |
| | 23.5 | 106 | 47 | 16.0 | 2 | 32 | 02.0 | 2.6022 | 15 | 20.58 |
| | 24.0 | 113 | 14 | 01.3 | +3 | 00 | 24.9 | 2.5846 | 15 | 26.85 |
| | 24.5 | 119 | 46 | 50.9 | 3 | 26 | 50.1 | 2.5667 | 15 | 33.30 |
| | 25.0 | 126 | 25 | 53.9 | 3 | 50 | 50.4 | 2.5490 | 15 | 39.80 |
| | 25.5 | 133 | 11 | 10.8 | 4 | 11 | 58.2 | 2.5317 | 15 | 46.21 |
| | 26.0 | 140 | 02 | 32.7 | 4 | 29 | 46.4 | 2.5152 | 15 | 52.42 |
| | 26.5 | 146 | 59 | 41.2 | 4 | 43 | 49.5 | 2.4999 | 15 | 58.26 |
| | 27.0 | 154 | 02 | 08.4 | +4 | 53 | 44.8 | 2.4859 | 16 | 03.63 |
| | 27.5 | 161 | 09 | 17.6 | 4 | 59 | 13.5 | 2.4737 | 16 | 08.40 |
| | 28.0 | 168 | 20 | 24.4 | 5 | 00 | 01.8 | 2.4634 | 16 | 12.47 |
| | 28.5 | 175 | 34 | 39.0 | 4 | 56 | 02.2 | 2.4550 | 16 | 15.76 |
| Mar. | 1.0 | 182 | 51 | 07.5 | 4 | 47 | 13.4 | 2.4489 | 16 | 18.22 |
| | 1.5 | 190 | 08 | 54.9 | 4 | 33 | 41.6 | 2.4448 | 16 | 19.84 |
| | 2.0 | 197 | 27 | 07.2 | +4 | 15 | 39.5 | 2.4429 | 16 | 20.61 |
| | 2.5 | 204 | 44 | 53.9 | 3 | 53 | 26.5 | 2.4430 | 16 | 20.57 |
| | 3.0 | 212 | 01 | 29.4 | 3 | 27 | 27.4 | 2.4450 | 16 | 19.76 |
| | 3.5 | 219 | 16 | 15.1 | 2 | 58 | 11.9 | 2.4487 | 16 | 18.27 |
| | 4.0 | 226 | 28 | 39.3 | 2 | 26 | 12.8 | 2.4540 | 16 | 16.17 |
| | 4.5 | 233 | 38 | 18.3 | 1 | 52 | 05.3 | 2.4606 | 16 | 13.56 |
| | 5.0 | 240 | 44 | 55.4 | +1 | 16 | 25.6 | 2.4683 | 16 | 10.52 |
| | 5.5 | 247 | 48 | 20.8 | 0 | 39 | 50.1 | 2.4769 | 16 | 07.15 |
| | 6.0 | 254 | 48 | 30.1 | 0 | 02 | 54.6 | 2.4863 | 16 | 03.51 |
| | 6.5 | 261 | 45 | 23.5 | +0 | 33 | 46.4 | 2.4962 | 15 | 59.69 |
| | 7.0 | 268 | 39 | 04.3 | -1 | 09 | 40.3 | 2.5065 | 15 | 55.73 |
| | 7.5 | 275 | 29 | 37.9 | 1 | 44 | 16.6 | 2.5171 | 15 | 51.69 |
| | 8.0 | 282 | 17 | 10.5 | -2 | 17 | 07.1 | 2.5280 | 15 | 47.61 |
| | 8.5 | 289 | 01 | 48.2 | 2 | 47 | 46.3 | 2.5389 | 15 | 43.51 |
| | 9.0 | 295 | 43 | 36.1 | 3 | 15 | 51.6 | 2.5500 | 15 | 39.41 |
| | 9.5 | 302 | 22 | 38.2 | 3 | 41 | 03.1 | 2.5612 | 15 | 35.32 |
| | 10.0 | 308 | 58 | 56.5 | -4 | 03 | 04.0 | 2.5724 | 15 | 31.25 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Longitude | | | Apparent Latitude | | | True Geocentric Distance (A. U.) | Semi Diameter | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | (X $10^{-3}$) | ' | " |
| Mar. | 10.0 | 308 | 58 | 56.5 | -4 | 03 | 04.0 | 2.5724 | 15 | 31.25 |
| | 10.5 | 315 | 32 | 31.4 | 4 | 21 | 40.9 | 2.5836 | 15 | 27.21 |
| | 11.0 | 322 | 03 | 21.5 | 4 | 36 | 43.3 | 2.5948 | 15 | 23.21 |
| | 11.5 | 328 | 31 | 24.1 | 4 | 48 | 04.1 | 2.6060 | 15 | 19.25 |
| | 12.0 | 334 | 56 | 35.5 | 4 | 55 | 39.3 | 2.6171 | 15 | 15.35 |
| | 12.5 | 341 | 18 | 51.9 | 4 | 59 | 28.2 | 2.6280 | 15 | 11.53 |
| | 13.0 | 347 | 38 | 09.8 | -4 | 59 | 33.2 | 2.6388 | 15 | 07.80 |
| | 13.5 | 353 | 54 | 26.7 | 4 | 55 | 59.2 | 2.6493 | 15 | 04.20 |
| | 14.0 | 0 | 07 | 41.8 | 4 | 48 | 53.9 | 2.6594 | 15 | 00.76 |
| | 14.5 | 6 | 17 | 56.5 | 4 | 38 | 27.0 | 2.6690 | 14 | 57.52 |
| | 15.0 | 12 | 25 | 15.3 | 4 | 24 | 50.3 | 2.6780 | 14 | 54.53 |
| | 15.5 | 18 | 29 | 45.5 | 4 | 08 | 17.0 | 2.6861 | 14 | 51.82 |
| | 16.0 | 24 | 31 | 38.2 | -3 | 49 | 01.4 | 2.6932 | 14 | 49.46 |
| | 16.5 | 30 | 31 | 08.1 | 3 | 27 | 18.7 | 2.6993 | 14 | 47.48 |
| | 17.0 | 36 | 28 | 33.6 | 3 | 03 | 24.7 | 2.7040 | 14 | 45.94 |
| | 17.5 | 42 | 24 | 16.9 | 2 | 37 | 35.6 | 2.7072 | 14 | 44.88 |
| | 18.0 | 48 | 18 | 43.5 | 2 | 10 | 07.5 | 2.7088 | 14 | 44.35 |
| | 18.5 | 54 | 12 | 22.6 | 1 | 41 | 17.1 | 2.7086 | 14 | 44.40 |
| | 19.0 | 60 | 05 | 46.3 | -1 | 11 | 20.6 | 2.7066 | 14 | 45.06 |
| | 19.5 | 65 | 59 | 29.7 | +0 | 40 | 34.7 | 2.7027 | 14 | 46.36 |
| | 20.0 | 71 | 54 | 10.0 | 0 | 09 | 16.1 | 2.6967 | 14 | 48.32 |
| | 20.5 | 77 | 50 | 26.5 | 0 | 22 | 18.3 | 2.6887 | 14 | 50.97 |
| | 21.0 | 83 | 49 | 00.0 | 0 | 53 | 50.9 | 2.6787 | 14 | 54.30 |
| | 21.5 | 89 | 50 | 31.9 | 1 | 25 | 03.4 | 2.6667 | 14 | 58.32 |
| | 22.0 | 95 | 55 | 43.8 | +1 | 55 | 37.0 | 2.6528 | 15 | 03.00 |
| | 22.5 | 102 | 05 | 16.6 | 2 | 25 | 11.3 | 2.6373 | 15 | 08.32 |
| | 23.0 | 108 | 19 | 49.3 | 2 | 53 | 25.2 | 2.6203 | 15 | 14.23 |
| | 23.5 | 114 | 39 | 58.4 | 3 | 19 | 55.9 | 2.6019 | 15 | 20.67 |
| | 24.0 | 121 | 06 | 16.0 | 3 | 44 | 19.8 | 2.5826 | 15 | 27.55 |
| | 24.5 | 127 | 39 | 08.8 | 4 | 06 | 11.8 | 2.5627 | 15 | 34.77 |
| | 25.0 | 134 | 18 | 56.6 | +4 | 25 | 06.6 | 2.5424 | 15 | 42.22 |
| | 25.5 | 141 | 05 | 50.8 | 4 | 40 | 38.4 | 2.5223 | 15 | 49.74 |
| | 26.0 | 147 | 59 | 52.8 | 4 | 52 | 22.4 | 2.5027 | 15 | 57.19 |
| | 26.5 | 155 | 00 | 53.4 | 4 | 59 | 55.6 | 2.4839 | 16 | 04.40 |
| | 27.0 | 162 | 08 | 31.5 | 5 | 02 | 58.0 | 2.4666 | 16 | 11.20 |
| | 27.5 | 169 | 22 | 14.0 | 5 | 01 | 14.2 | 2.4509 | 16 | 17.39 |
| | 28.0 | 176 | 41 | 16.7 | +4 | 54 | 34.4 | 2.4374 | 16 | 22.83 |
| | 28.5 | 184 | 04 | 44.8 | 4 | 42 | 56.0 | 2.4262 | 16 | 27.36 |
| | 29.0 | 191 | 31 | 35.9 | 4 | 26 | 24.0 | 2.4176 | 16 | 30.86 |
| | 29.5 | 199 | 00 | 41.4 | 4 | 05 | 11.8 | 2.4118 | 16 | 33.24 |
| | 30.0 | 206 | 30 | 50.4 | 3 | 39 | 40.9 | 2.4089 | 16 | 34.45 |
| | 30.5 | 214 | 00 | 52.8 | 3 | 10 | 20.4 | 2.4088 | 16 | 34.47 |
| | 31.0 | 221 | 29 | 41.8 | +2 | 37 | 45.2 | 2.4115 | 16 | 33.36 |
| | 31.5 | 228 | 56 | 16.9 | 2 | 02 | 35.2 | 2.4168 | 16 | 31.18 |
| Apr. | 1.0 | 236 | 19 | 45.9 | 1 | 25 | 32.7 | 2.4245 | 16 | 28.03 |
| | 1.5 | 243 | 39 | 26.0 | 0 | 47 | 21.4 | 2.4344 | 16 | 24.05 |
| | 2.0 | 250 | 54 | 44.2 | +0 | 08 | 44.1 | 2.4460 | 16 | 19.38 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Longitude | | | Apparent Latitude | | | True Geocentric Distance (A. U.) | Semi Diameter | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | (X $10^{-3}$) | ' | " |
| Apr. | 1.0 | 236 | 19 | 45.9 | +1 | 25 | 32.7 | 2.4245 | 16 | 28.03 |
| | 1.5 | 243 | 39 | 26.0 | 0 | 47 | 21.4 | 2.4344 | 16 | 24.05 |
| | 2.0 | 250 | 54 | 44.2 | 0 | 08 | 44.1 | 2.4460 | 16 | 19.38 |
| | 2.5 | 258 | 05 | 17.6 | +0 | 29 | 38.3 | 2.4591 | 16 | 14.16 |
| | 3.0 | 265 | 10 | 52.2 | -1 | 07 | 07.9 | 2.4733 | 16 | 08.54 |
| | 3.5 | 272 | 11 | 22.2 | 1 | 43 | 10.4 | 2.4884 | 16 | 02.67 |
| | 4.0 | 279 | 06 | 48.7 | -2 | 17 | 15.6 | 2.5040 | 15 | 56.67 |
| | 4.5 | 285 | 57 | 18.0 | 2 | 48 | 57.6 | 2.5199 | 15 | 50.65 |
| | 5.0 | 292 | 43 | 00.5 | 3 | 17 | 54.3 | 2.5357 | 15 | 44.70 |
| | 5.5 | 299 | 24 | 09.5 | 3 | 43 | 47.6 | 2.5514 | 15 | 38.90 |
| | 6.0 | 306 | 00 | 59.7 | 4 | 06 | 22.9 | 2.5667 | 15 | 33.30 |
| | 6.5 | 312 | 33 | 46.7 | 4 | 25 | 29.2 | 2.5815 | 15 | 27.95 |
| | 7.0 | 319 | 02 | 45.8 | -4 | 40 | 58.2 | 2.5957 | 15 | 22.87 |
| | 7.5 | 325 | 28 | 11.7 | 4 | 52 | 44.9 | 2.6093 | 15 | 18.08 |
| | 8.0 | 331 | 50 | 18.2 | 5 | 00 | 46.5 | 2.6221 | 15 | 13.58 |
| | 8.5 | 338 | 09 | 17.6 | 5 | 05 | 02.9 | 2.6342 | 15 | 09.40 |
| | 9.0 | 344 | 25 | 21.1 | 5 | 05 | 36.3 | 2.6455 | 15 | 05.50 |
| | 9.5 | 350 | 38 | 38.6 | 5 | 02 | 31.2 | 2.6561 | 15 | 01.91 |
| | 10.0 | 356 | 49 | 19.3 | -4 | 55 | 54.1 | 2.6658 | 14 | 58.60 |
| | 10.5 | 2 | 57 | 31.3 | 4 | 45 | 53.3 | 2.6748 | 14 | 55.58 |
| | 11.0 | 9 | 03 | 22.7 | 4 | 32 | 39.2 | 2.6830 | 14 | 52.85 |
| | 11.5 | 15 | 07 | 01.6 | 4 | 16 | 23.5 | 2.6904 | 14 | 50.40 |
| | 12.0 | 21 | 08 | 36.7 | 3 | 57 | 19.5 | 2.6969 | 14 | 48.25 |
| | 12.5 | 27 | 08 | 17.6 | 3 | 35 | 41.8 | 2.7025 | 14 | 46.40 |
| | 13.0 | 33 | 06 | 15.3 | -3 | 11 | 46.0 | 2.7072 | 14 | 44.88 |
| | 13.5 | 39 | 02 | 42.5 | 2 | 45 | 48.3 | 2.7108 | 14 | 43.70 |
| | 14.0 | 44 | 57 | 53.8 | 2 | 18 | 06.0 | 2.7133 | 14 | 42.88 |
| | 14.5 | 50 | 52 | 06.1 | 1 | 48 | 56.4 | 2.7146 | 14 | 42.47 |
| | 15.0 | 56 | 45 | 39.0 | -1 | 18 | 37.3 | 2.7146 | 14 | 42.48 |
| | 15.5 | 62 | 38 | 54.4 | +0 | 47 | 26.6 | 2.7131 | 14 | 42.94 |
| | 16.0 | 68 | 32 | 16.7 | +0 | 15 | 42.5 | 2.7102 | 14 | 43.90 |
| | 16.5 | 74 | 26 | 13.2 | 0 | 16 | 17.0 | 2.7056 | 14 | 45.38 |
| | 17.0 | 80 | 21 | 13.3 | 0 | 48 | 13.6 | 2.6994 | 14 | 47.42 |
| | 17.5 | 86 | 17 | 49.0 | 1 | 19 | 48.9 | 2.6915 | 14 | 50.03 |
| | 18.0 | 92 | 16 | 34.1 | 1 | 50 | 44.5 | 2.6818 | 14 | 53.25 |
| | 18.5 | 98 | 18 | 04.1 | 2 | 20 | 41.3 | 2.6704 | 14 | 57.07 |
| | 19.0 | 104 | 22 | 55.6 | +2 | 49 | 20.0 | 2.6572 | 15 | 01.52 |
| | 19.5 | 110 | 31 | 45.9 | 3 | 16 | 20.8 | 2.6424 | 15 | 06.59 |
| | 20.0 | 116 | 45 | 12.0 | 3 | 41 | 23.0 | 2.6260 | 15 | 12.25 |
| | 20.5 | 123 | 03 | 50.0 | 4 | 04 | 05.5 | 2.6081 | 15 | 18.48 |
| | 21.0 | 129 | 28 | 13.6 | 4 | 24 | 06.4 | 2.5891 | 15 | 25.22 |
| | 21.5 | 135 | 58 | 53.5 | 4 | 41 | 03.6 | 2.5692 | 15 | 32.41 |
| | 22.0 | 142 | 36 | 15.4 | +4 | 54 | 34.7 | 2.5485 | 15 | 39.96 |
| | 22.5 | 149 | 20 | 39.0 | 5 | 04 | 17.7 | 2.5276 | 15 | 47.75 |
| | 23.0 | 156 | 12 | 16.2 | 5 | 09 | 51.9 | 2.5067 | 15 | 55.65 |
| | 23.5 | 163 | 11 | 09.5 | 5 | 10 | 58.8 | 2.4863 | 16 | 03.50 |
| | 24.0 | 170 | 17 | 11.2 | +5 | 07 | 22.9 | 2.4668 | 16 | 11.13 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Longitude | | | Apparent Latitude | | | True Geocentric Distance (A. U.) | Semi Diameter | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | (X $10^{-3}$) | ' | " |
| Apr. | 24.0 | 170 | 17 | 11.2 | +5 | 07 | 22.9 | 2.4668 | 16 | 11.13 |
| | 24.5 | 177 | 30 | 01.6 | 4 | 58 | 53.6 | 2.4486 | 16 | 18.34 |
| | 25.0 | 184 | 49 | 09.2 | 4 | 45 | 25.9 | 2.4322 | 16 | 24.94 |
| | 25.5 | 192 | 13 | 50.5 | 4 | 27 | 02.2 | 2.4179 | 16 | 30.74 |
| | 26.0 | 199 | 43 | 11.0 | 4 | 03 | 52.8 | 2.4062 | 16 | 35.55 |
| | 26.5 | 207 | 16 | 06.5 | 3 | 36 | 16.7 | 2.3974 | 16 | 39.23 |
| | 27.0 | 214 | 51 | 26.0 | +3 | 04 | 41.6 | 2.3916 | 16 | 41.64 |
| | 27.5 | 222 | 27 | 54.2 | 2 | 29 | 43.0 | 2.3891 | 16 | 42.71 |
| | 28.0 | 230 | 04 | 14.5 | 1 | 52 | 02.9 | 2.3898 | 16 | 42.41 |
| | 28.5 | 237 | 39 | 12.7 | 1 | 12 | 28.0 | 2.3937 | 16 | 40.77 |
| | 29.0 | 245 | 11 | 39.5 | 0 | 31 | 47.6 | 2.4007 | 16 | 37.86 |
| | 29.5 | 252 | 40 | 33.3 | 0 | 09 | 08.8 | 2.4105 | 16 | 33.80 |
| | 30.0 | 260 | 05 | 01.5 | +0 | 49 | 33.6 | 2.4228 | 16 | 28.74 |
| | 30.5 | 267 | 24 | 21.9 | -1 | 28 | 42.6 | 2.4373 | 16 | 22.85 |
| May | 1.0 | 274 | 38 | 03.0 | 2 | 05 | 56.5 | 2.4537 | 16 | 16.31 |
| | 1.5 | 281 | 45 | 43.7 | 2 | 40 | 41.7 | 2.4714 | 16 | 09.31 |
| | 2.0 | 288 | 47 | 12.6 | 3 | 12 | 30.4 | 2.4900 | 16 | 02.04 |
| | 2.5 | 295 | 42 | 26.9 | 3 | 41 | 00.8 | 2.5093 | 15 | 54.66 |
| | 3.0 | 302 | 31 | 31.3 | -4 | 05 | 56.4 | 2.5288 | 15 | 47.30 |
| | 3.5 | 309 | 14 | 36.5 | 4 | 27 | 05.8 | 2.5481 | 15 | 40.11 |
| | 4.0 | 315 | 51 | 58.1 | 4 | 44 | 21.9 | 2.5671 | 15 | 33.18 |
| | 4.5 | 322 | 23 | 55.2 | 4 | 57 | 41.1 | 2.5853 | 15 | 26.58 |
| | 5.0 | 328 | 50 | 49.4 | 5 | 07 | 03.1 | 2.6027 | 15 | 20.40 |
| | 5.5 | 335 | 13 | 03.7 | 5 | 12 | 30.0 | 2.6191 | 15 | 14.65 |
| | 6.0 | 341 | 31 | 01.8 | -5 | 14 | 06.1 | 2.6342 | 15 | 09.38 |
| | 6.5 | 347 | 45 | 07.6 | 5 | 11 | 57.7 | 2.6482 | 15 | 04.60 |
| | 7.0 | 353 | 55 | 44.5 | 5 | 06 | 12.3 | 2.6608 | 15 | 00.31 |
| | 7.5 | 0 | 03 | 15.1 | 4 | 56 | 59.1 | 2.6721 | 14 | 56.50 |
| | 8.0 | 6 | 08 | 00.9 | 4 | 44 | 28.4 | 2.6821 | 14 | 53.17 |
| | 8.5 | 12 | 10 | 22.5 | 4 | 28 | 51.5 | 2.6907 | 14 | 50.29 |
| | 9.0 | 18 | 10 | 39.2 | -4 | 10 | 21.2 | 2.6981 | 14 | 47.86 |
| | 9.5 | 24 | 09 | 09.3 | 3 | 49 | 11.0 | 2.7042 | 14 | 45.84 |
| | 10.0 | 30 | 06 | 10.0 | 3 | 25 | 35.5 | 2.7092 | 14 | 44.23 |
| | 10.5 | 36 | 01 | 57.9 | 2 | 59 | 50.1 | 2.7129 | 14 | 43.01 |
| | 11.0 | 41 | 56 | 49.1 | 2 | 32 | 11.4 | 2.7155 | 14 | 42.17 |
| | 11.5 | 47 | 50 | 59.4 | 2 | 02 | 56.4 | 2.7170 | 14 | 41.69 |
| | 12.0 | 53 | 44 | 44.6 | -1 | 32 | 22.9 | 2.7173 | 14 | 41.57 |
| | 12.5 | 59 | 38 | 20.8 | -1 | 00 | 49.4 | 2.7166 | 14 | 41.81 |
| | 13.0 | 65 | 32 | 04.7 | +0 | 28 | 34.7 | 2.7147 | 14 | 42.42 |
| | 13.5 | 71 | 26 | 14.0 | 0 | 04 | 02.0 | 2.7117 | 14 | 43.41 |
| | 14.0 | 77 | 21 | 07.2 | 0 | 36 | 41.3 | 2.7075 | 14 | 44.79 |
| | 14.5 | 83 | 17 | 04.3 | 1 | 09 | 03.7 | 2.7020 | 14 | 46.57 |
| | 15.0 | 89 | 14 | 26.5 | +1 | 40 | 49.5 | 2.6953 | 14 | 48.77 |
| | 15.5 | 95 | 13 | 36.6 | 2 | 11 | 39.0 | 2.6873 | 14 | 51.42 |
| | 16.0 | 101 | 14 | 58.9 | 2 | 41 | 12.5 | 2.6780 | 14 | 54.53 |
| | 16.5 | 107 | 18 | 58.9 | 3 | 09 | 10.6 | 2.6673 | 14 | 58.11 |
| | 17.0 | 113 | 26 | 03.4 | +3 | 35 | 13.5 | 2.6552 | 15 | 02.19 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Longitude | | | Apparent Latitude | | | True Geocentric Distance (A. U.) | Semi Diameter | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | (X $10^{-3}$) | | |
| | | ° | ' | " | ° | ' | " | | ' | " |
| May | 17.0 | 113 | 26 | 03.4 | +3 | 35 | 13.5 | 2.6552 | 15 | 02.19 |
| | 17.5 | 119 | 36 | 40.4 | 3 | 59 | 01.8 | 2.6418 | 15 | 06.77 |
| | 18.0 | 125 | 51 | 17.9 | 4 | 20 | 16.1 | 2.6271 | 15 | 11.85 |
| | 18.5 | 132 | 10 | 24.4 | 4 | 38 | 36.9 | 2.6111 | 15 | 17.43 |
| | 19.0 | 138 | 34 | 27.5 | 4 | 53 | 45.4 | 2.5941 | 15 | 23.47 |
| | 19.5 | 145 | 03 | 53.4 | 5 | 05 | 22.8 | 2.5760 | 15 | 29.94 |
| | 20.0 | 151 | 39 | 05.8 | +5 | 13 | 11.4 | 2.5572 | 15 | 36.79 |
| | 20.5 | 158 | 20 | 24.9 | 5 | 16 | 54.6 | 2.5378 | 15 | 43.94 |
| | 21.0 | 165 | 08 | 06.0 | 5 | 16 | 17.7 | 2.5182 | 15 | 51.30 |
| | 21.5 | 172 | 02 | 18.7 | 5 | 11 | 08.5 | 2.4986 | 15 | 58.75 |
| | 22.0 | 179 | 03 | 05.0 | 5 | 01 | 18.3 | 2.4795 | 16 | 06.14 |
| | 22.5 | 186 | 10 | 18.5 | 4 | 46 | 43.0 | 2.4612 | 16 | 13.33 |
| | 23.0 | 193 | 23 | 43.2 | +4 | 27 | 24.1 | 2.4441 | 16 | 20.14 |
| | 23.5 | 200 | 42 | 53.2 | 4 | 03 | 29.4 | 2.4286 | 16 | 26.37 |
| | 24.0 | 208 | 07 | 12.2 | 3 | 35 | 14.4 | 2.4152 | 16 | 31.85 |
| | 24.5 | 215 | 35 | 53.6 | 3 | 03 | 02.3 | 2.4042 | 16 | 36.39 |
| | 25.0 | 223 | 08 | 02.0 | 2 | 27 | 24.3 | 2.3959 | 16 | 39.83 |
| | 25.5 | 230 | 42 | 34.2 | 1 | 48 | 58.7 | 2.3906 | 16 | 42.05 |
| | 26.0 | 238 | 18 | 21.7 | +1 | 08 | 30.1 | 2.3885 | 16 | 42.94 |
| | 26.5 | 245 | 54 | 12.6 | 0 | 26 | 47.5 | 2.3896 | 16 | 42.46 |
| | 27.0 | 253 | 28 | 55.0 | 0 | 15 | 17.8 | 2.3940 | 16 | 40.63 |
| | 27.5 | 261 | 01 | 19.4 | +0 | 56 | 54.5 | 2.4015 | 16 | 37.50 |
| | 28.0 | 268 | 30 | 20.9 | -1 | 37 | 13.7 | 2.4120 | 16 | 33.17 |
| | 28.5 | 275 | 55 | 02.2 | 2 | 15 | 30.5 | 2.4251 | 16 | 27.80 |
| | 29.0 | 283 | 14 | 34.3 | -2 | 51 | 05.8 | 2.4406 | 16 | 21.54 |
| | 29.5 | 290 | 28 | 18.3 | 3 | 23 | 27.2 | 2.4580 | 16 | 14.59 |
| | 30.0 | 297 | 35 | 45.4 | 3 | 52 | 09.4 | 2.4769 | 16 | 07.15 |
| | 30.5 | 304 | 36 | 37.2 | 4 | 16 | 54.2 | 2.4969 | 15 | 59.41 |
| | 31.0 | 311 | 30 | 44.9 | 4 | 37 | 29.6 | 2.5175 | 15 | 51.54 |
| | 31.5 | 318 | 18 | 08.6 | 4 | 53 | 49.7 | 2.5384 | 15 | 43.72 |
| June | 1.0 | 324 | 58 | 56.4 | -5 | 05 | 53.2 | 2.5591 | 15 | 36.08 |
| | 1.5 | 331 | 33 | 22.8 | 5 | 13 | 42.9 | 2.5793 | 15 | 28.74 |
| | 2.0 | 338 | 01 | 47.9 | 5 | 17 | 24.8 | 2.5987 | 15 | 21.81 |
| | 2.5 | 344 | 24 | 36.0 | 5 | 17 | 07.2 | 2.6170 | 15 | 15.36 |
| | 3.0 | 350 | 42 | 14.5 | 5 | 13 | 00.2 | 2.6341 | 15 | 09.44 |
| | 3.5 | 356 | 55 | 12.9 | 5 | 05 | 15.2 | 2.6496 | 15 | 04.09 |
| | 4.0 | 3 | 04 | 02.0 | -4 | 54 | 04.3 | 2.6636 | 14 | 59.35 |
| | 4.5 | 9 | 09 | 13.2 | 4 | 39 | 40.7 | 2.6759 | 14 | 55.21 |
| | 5.0 | 15 | 11 | 17.8 | 4 | 22 | 17.8 | 2.6866 | 14 | 51.67 |
| | 5.5 | 21 | 10 | 46.5 | 4 | 02 | 09.7 | 2.6954 | 14 | 48.73 |
| | 6.0 | 27 | 08 | 08.9 | 3 | 39 | 30.9 | 2.7026 | 14 | 46.37 |
| | 6.5 | 33 | 03 | 53.7 | 3 | 14 | 36.4 | 2.7081 | 14 | 44.56 |
| | 7.0 | 38 | 58 | 27.9 | -2 | 47 | 41.7 | 2.7121 | 14 | 43.28 |
| | 7.5 | 44 | 52 | 17.1 | 2 | 19 | 03.0 | 2.7145 | 14 | 42.50 |
| | 8.0 | 50 | 45 | 45.1 | 1 | 48 | 57.0 | 2.7154 | 14 | 42.19 |
| | 8.5 | 56 | 39 | 14.3 | -1 | 17 | 41.4 | 2.7151 | 14 | 42.31 |
| | 9.0 | 62 | 33 | 05.5 | +0 | 45 | 34.2 | 2.7134 | 14 | 42.85 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Longitude | | | Apparent Latitude | | | True Geocentric Distance (A. U.) | Semi Diameter | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | (X $10^{-3}$) | | |
| | | ° | ' | " | ° | ' | " | | ' | " |
| June | 9.0 | 62 | 33 | 05.5 | +0 | 45 | 34.2 | 2.7134 | 14 | 42.85 |
| | 9.5 | 68 | 27 | 38.1 | 0 | 12 | 54.3 | 2.7106 | 14 | 43.77 |
| | 10.0 | 74 | 23 | 09.9 | 0 | 19 | 58.9 | 2.7067 | 14 | 45.05 |
| | 10.5 | 80 | 19 | 58.1 | 0 | 52 | 45.4 | 2.7017 | 14 | 46.67 |
| | 11.0 | 86 | 18 | 18.5 | 1 | 25 | 04.9 | 2.6958 | 14 | 48.62 |
| | 11.5 | 92 | 18 | 26.6 | 1 | 56 | 36.7 | 2.6889 | 14 | 50.88 |
| | 12.0 | 98 | 20 | 37.0 | +2 | 27 | 00.1 | 2.6812 | 14 | 53.46 |
| | 12.5 | 104 | 25 | 04.4 | 2 | 55 | 54.2 | 2.6726 | 14 | 56.34 |
| | 13.0 | 110 | 32 | 03.2 | 3 | 22 | 58.7 | 2.6631 | 14 | 59.53 |
| | 13.5 | 116 | 41 | 48.0 | 3 | 47 | 53.4 | 2.6527 | 15 | 03.04 |
| | 14.0 | 122 | 54 | 33.5 | 4 | 10 | 18.7 | 2.6416 | 15 | 06.86 |
| | 14.5 | 129 | 10 | 34.9 | 4 | 29 | 55.9 | 2.6296 | 15 | 11.00 |
| | 15.0 | 135 | 30 | 07.4 | +4 | 46 | 27.0 | 2.6167 | 15 | 15.47 |
| | 15.5 | 141 | 53 | 26.4 | 4 | 59 | 35.3 | 2.6031 | 15 | 20.26 |
| | 16.0 | 148 | 20 | 47.6 | 5 | 09 | 05.3 | 2.5887 | 15 | 25.36 |
| | 16.5 | 154 | 52 | 25.8 | 5 | 14 | 43.1 | 2.5737 | 15 | 30.76 |
| | 17.0 | 161 | 28 | 35.4 | 5 | 16 | 16.7 | 2.5581 | 15 | 36.43 |
| | 17.5 | 168 | 09 | 29.4 | 5 | 13 | 36.3 | 2.5421 | 15 | 42.33 |
| | 18.0 | 174 | 55 | 18.8 | +5 | 06 | 34.8 | 2.5258 | 15 | 48.41 |
| | 18.5 | 181 | 46 | 11.6 | 4 | 55 | 08.4 | 2.5095 | 15 | 54.58 |
| | 19.0 | 188 | 42 | 12.5 | 4 | 39 | 16.7 | 2.4933 | 16 | 00.77 |
| | 19.5 | 195 | 43 | 21.3 | 4 | 19 | 04.2 | 2.4777 | 16 | 06.85 |
| | 20.0 | 202 | 49 | 32.5 | 3 | 54 | 39.9 | 2.4627 | 16 | 12.72 |
| | 20.5 | 210 | 00 | 34.1 | 3 | 26 | 18.9 | 2.4489 | 16 | 18.22 |
| | 21.0 | 217 | 16 | 07.2 | +2 | 54 | 21.9 | 2.4364 | 16 | 23.22 |
| | 21.5 | 224 | 35 | 45.1 | 2 | 19 | 16.1 | 2.4257 | 16 | 27.55 |
| | 22.0 | 231 | 58 | 53.3 | 1 | 41 | 34.7 | 2.4171 | 16 | 31.08 |
| | 22.5 | 239 | 24 | 49.9 | 1 | 01 | 56.6 | 2.4108 | 16 | 33.66 |
| | 23.0 | 246 | 52 | 45.8 | 0 | 21 | 05.2 | 2.4071 | 16 | 35.18 |
| | 23.5 | 254 | 21 | 46.2 | +0 | 20 | 12.5 | 2.4062 | 16 | 35.56 |
| | 24.0 | 261 | 50 | 51.8 | -1 | 01 | 08.4 | 2.4081 | 16 | 34.76 |
| | 24.5 | 269 | 19 | 01.1 | 1 | 40 | 54.3 | 2.4130 | 16 | 32.77 |
| | 25.0 | 276 | 45 | 12.1 | 2 | 18 | 44.8 | 2.4206 | 16 | 29.63 |
| | 25.5 | 284 | 08 | 24.9 | 2 | 53 | 58.3 | 2.4310 | 16 | 25.42 |
| | 26.0 | 291 | 27 | 43.9 | 3 | 25 | 59.2 | 2.4438 | 16 | 20.26 |
| | 26.5 | 298 | 42 | 19.7 | 3 | 54 | 18.2 | 2.4588 | 16 | 14.28 |
| | 27.0 | 305 | 51 | 30.7 | -4 | 18 | 33.6 | 2.4756 | 16 | 07.65 |
| | 27.5 | 312 | 54 | 44.0 | 4 | 38 | 30.5 | 2.4939 | 16 | 00.55 |
| | 28.0 | 319 | 51 | 36.4 | 4 | 54 | 01.1 | 2.5133 | 15 | 53.16 |
| | 28.5 | 326 | 41 | 54.3 | 5 | 05 | 03.5 | 2.5333 | 15 | 45.63 |
| | 29.0 | 333 | 25 | 33.4 | 5 | 11 | 41.1 | 2.5535 | 15 | 38.13 |
| | 29.5 | 340 | 02 | 38.1 | 5 | 14 | 01.2 | 2.5736 | 15 | 30.81 |
| | 30.0 | 346 | 33 | 20.6 | -5 | 12 | 14.5 | 2.5932 | 15 | 23.79 |
| | 30.5 | 352 | 57 | 59.5 | 5 | 06 | 33.9 | 2.6119 | 15 | 17.17 |
| July | 1.0 | 359 | 16 | 59.3 | 4 | 57 | 13.7 | 2.6294 | 15 | 11.05 |
| | 1.5 | 5 | 30 | 48.9 | 4 | 44 | 29.4 | 2.6456 | 15 | 05.48 |
| | 2.0 | 11 | 40 | 00.3 | -4 | 28 | 36.7 | 2.6602 | 15 | 00.52 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Longitude | | | Apparent Latitude | | | True Geocentric Distance (A. U.) | Semi Diameter | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | (X $10^{-3}$) | ' | " |
| July | 1.0 | 359 | 16 | 59.3 | -4 | 57 | 13.7 | 2.6294 | 15 | 11.05 |
| | 1.5 | 5 | 30 | 48.9 | 4 | 44 | 29.4 | 2.6456 | 15 | 05.48 |
| | 2.0 | 11 | 40 | 00.3 | 4 | 28 | 36.7 | 2.6602 | 15 | 00.52 |
| | 2.5 | 17 | 45 | 08.4 | 4 | 09 | 51.8 | 2.6730 | 14 | 56.20 |
| | 3.0 | 23 | 46 | 49.0 | 3 | 48 | 30.8 | 2.6839 | 14 | 52.54 |
| | 3.5 | 29 | 45 | 39.2 | 3 | 24 | 49.6 | 2.6929 | 14 | 49.56 |
| | 4.0 | 35 | 42 | 15.9 | -2 | 59 | 04.3 | 2.7000 | 14 | 47.24 |
| | 4.5 | 41 | 37 | 15.5 | 2 | 31 | 31.1 | 2.7050 | 14 | 45.58 |
| | 5.0 | 47 | 31 | 13.4 | 2 | 02 | 26.1 | 2.7082 | 14 | 44.55 |
| | 5.5 | 53 | 24 | 43.8 | 1 | 32 | 05.9 | 2.7095 | 14 | 44.12 |
| | 6.0 | 59 | 18 | 18.9 | -1 | 00 | 47.4 | 2.7090 | 14 | 44.27 |
| | 6.5 | 65 | 12 | 29.0 | +0 | 28 | 48.2 | 2.7069 | 14 | 44.95 |
| | 7.0 | 71 | 07 | 42.0 | +0 | 03 | 33.7 | 2.7034 | 14 | 46.13 |
| | 7.5 | 77 | 04 | 23.5 | 0 | 35 | 59.4 | 2.6984 | 14 | 47.76 |
| | 8.0 | 83 | 02 | 56.1 | 1 | 08 | 09.4 | 2.6922 | 14 | 49.79 |
| | 8.5 | 89 | 03 | 40.1 | 1 | 39 | 43.4 | 2.6850 | 14 | 52.19 |
| | 9.0 | 95 | 06 | 52.6 | 2 | 10 | 20.7 | 2.6768 | 14 | 54.91 |
| | 9.5 | 101 | 12 | 48.2 | 2 | 39 | 40.0 | 2.6679 | 14 | 57.90 |
| | 10.0 | 107 | 21 | 38.6 | +3 | 07 | 20.1 | 2.6583 | 15 | 01.14 |
| | 10.5 | 113 | 33 | 33.1 | 3 | 32 | 59.5 | 2.6482 | 15 | 04.58 |
| | 11.0 | 119 | 48 | 38.5 | 3 | 56 | 17.3 | 2.6377 | 15 | 08.20 |
| | 11.5 | 126 | 06 | 59.5 | 4 | 16 | 53.4 | 2.6268 | 15 | 11.97 |
| | 12.0 | 132 | 28 | 39.3 | 4 | 34 | 28.7 | 2.6156 | 15 | 15.87 |
| | 12.5 | 138 | 53 | 39.2 | 4 | 48 | 45.5 | 2.6042 | 15 | 19.88 |
| | 13.0 | 145 | 21 | 59.8 | +4 | 59 | 28.2 | 2.5926 | 15 | 23.99 |
| | 13.5 | 151 | 53 | 41.0 | 5 | 06 | 23.1 | 2.5809 | 15 | 28.18 |
| | 14.0 | 158 | 28 | 42.2 | 5 | 09 | 19.4 | 2.5690 | 15 | 32.46 |
| | 14.5 | 165 | 07 | 02.9 | 5 | 08 | 08.9 | 2.5571 | 15 | 36.80 |
| | 15.0 | 171 | 48 | 42.5 | 5 | 02 | 46.3 | 2.5452 | 15 | 41.20 |
| | 15.5 | 178 | 33 | 40.9 | 4 | 53 | 10.1 | 2.5332 | 15 | 45.64 |
| | 16.0 | 185 | 21 | 57.9 | +4 | 39 | 22.1 | 2.5214 | 15 | 50.08 |
| | 16.5 | 192 | 13 | 33.4 | 4 | 21 | 27.8 | 2.5097 | 15 | 54.51 |
| | 17.0 | 199 | 08 | 26.7 | 3 | 59 | 36.9 | 2.4983 | 15 | 58.87 |
| | 17.5 | 206 | 06 | 36.4 | 3 | 34 | 03.1 | 2.4873 | 16 | 03.11 |
| | 18.0 | 213 | 07 | 59.4 | 3 | 05 | 04.6 | 2.4769 | 16 | 07.17 |
| | 18.5 | 220 | 12 | 30.2 | 2 | 33 | 03.6 | 2.4672 | 16 | 10.96 |
| | 19.0 | 227 | 20 | 00.2 | +1 | 58 | 27.0 | 2.4585 | 16 | 14.40 |
| | 19.5 | 234 | 30 | 17.0 | 1 | 21 | 45.8 | 2.4509 | 16 | 17.41 |
| | 20.0 | 241 | 43 | 03.4 | 0 | 43 | 34.6 | 2.4447 | 16 | 19.87 |
| | 20.5 | 248 | 57 | 56.9 | 0 | 04 | 31.6 | 2.4402 | 16 | 21.70 |
| | 21.0 | 256 | 14 | 29.6 | +0 | 34 | 42.8 | 2.4374 | 16 | 22.80 |
| | 21.5 | 263 | 32 | 07.9 | -1 | 13 | 26.7 | 2.4367 | 16 | 23.11 |
| | 22.0 | 270 | 50 | 12.8 | -1 | 50 | 58.0 | 2.4380 | 16 | 22.56 |
| | 22.5 | 278 | 08 | 01.1 | 2 | 26 | 36.0 | 2.4416 | 16 | 21.13 |
| | 23.0 | 285 | 24 | 46.1 | 2 | 59 | 42.6 | 2.4474 | 16 | 18.81 |
| | 23.5 | 292 | 39 | 39.4 | 3 | 29 | 43.7 | 2.4554 | 16 | 15.61 |
| | 24.0 | 299 | 51 | 52.5 | -3 | 56 | 10.4 | 2.4655 | 16 | 11.61 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Longitude ° | ' | " | Apparent Latitude ° | ' | " | True Geocentric Distance (A. U.) (X $10^{-3}$) | Semi Diameter ' | " |
|---|---|---|---|---|---|---|---|---|---|---|
| July | 24.0 | 299 | 51 | 52.5 | -3 | 56 | 10.4 | 2.4655 | 16 | 11.61 |
| | 24.5 | 307 | 00 | 39.0 | 4 | 18 | 39.7 | 2.4776 | 16 | 06.86 |
| | 25.0 | 314 | 05 | 15.9 | 4 | 36 | 55.1 | 2.4915 | 16 | 01.49 |
| | 25.5 | 321 | 05 | 05.9 | 4 | 50 | 46.8 | 2.5068 | 15 | 55.60 |
| | 26.0 | 327 | 59 | 38.3 | 5 | 00 | 10.8 | 2.5234 | 15 | 49.34 |
| | 26.5 | 334 | 48 | 30.2 | 5 | 05 | 09.3 | 2.5408 | 15 | 42.83 |
| | 27.0 | 341 | 31 | 27.1 | -5 | 05 | 49.0 | 2.5587 | 15 | 36.22 |
| | 27.5 | 348 | 08 | 22.9 | 5 | 02 | 20.7 | 2.5768 | 15 | 29.64 |
| | 28.0 | 354 | 39 | 19.6 | 4 | 54 | 58.2 | 2.5947 | 15 | 23.23 |
| | 28.5 | 1 | 04 | 26.9 | 4 | 43 | 57.5 | 2.6121 | 15 | 17.09 |
| | 29.0 | 7 | 24 | 01.7 | 4 | 29 | 35.9 | 2.6286 | 15 | 11.32 |
| | 29.5 | 13 | 38 | 26.7 | 4 | 12 | 11.4 | 2.6440 | 15 | 06.02 |
| | 30.0 | 19 | 48 | 09.8 | -3 | 52 | 02.6 | 2.6580 | 15 | 01.25 |
| | 30.5 | 25 | 53 | 43.2 | 3 | 29 | 27.5 | 2.6704 | 14 | 57.08 |
| | 31.0 | 31 | 55 | 42.0 | 3 | 04 | 44.3 | 2.6809 | 14 | 53.55 |
| | 31.5 | 37 | 54 | 44.1 | 2 | 38 | 10.4 | 2.6895 | 14 | 50.69 |
| Aug. | 1.0 | 43 | 51 | 28.8 | 2 | 10 | 03.2 | 2.6961 | 14 | 48.52 |
| | 1.5 | 49 | 46 | 36.1 | 1 | 40 | 39.5 | 2.7005 | 14 | 47.05 |
| | 2.0 | 55 | 40 | 46.5 | -1 | 10 | 16.0 | 2.7029 | 14 | 46.28 |
| | 2.5 | 61 | 34 | 39.8 | +0 | 39 | 09.7 | 2.7032 | 14 | 46.19 |
| | 3.0 | 67 | 28 | 55.0 | 0 | 07 | 37.4 | 2.7014 | 14 | 46.76 |
| | 3.5 | 73 | 24 | 09.6 | 0 | 24 | 03.6 | 2.6978 | 14 | 47.96 |
| | 4.0 | 79 | 20 | 58.8 | 0 | 55 | 35.4 | 2.6923 | 14 | 49.76 |
| | 4.5 | 85 | 19 | 55.5 | 1 | 26 | 39.6 | 2.6853 | 14 | 52.10 |
| | 5.0 | 91 | 21 | 29.5 | +1 | 56 | 56.8 | 2.6768 | 14 | 54.94 |
| | 5.5 | 97 | 26 | 07.1 | 2 | 26 | 07.2 | 2.6670 | 14 | 58.21 |
| | 6.0 | 103 | 34 | 10.7 | 2 | 53 | 50.2 | 2.6562 | 15 | 01.86 |
| | 6.5 | 109 | 45 | 58.4 | 3 | 19 | 44.6 | 2.6446 | 15 | 05.82 |
| | 7.0 | 116 | 01 | 43.7 | 3 | 43 | 29.0 | 2.6324 | 15 | 10.02 |
| | 7.5 | 122 | 21 | 35.2 | 4 | 04 | 42.2 | 2.6198 | 15 | 14.38 |
| | 8.0 | 128 | 45 | 36.8 | +4 | 23 | 03.4 | 2.6071 | 15 | 18.85 |
| | 8.5 | 135 | 13 | 47.4 | 4 | 38 | 13.0 | 2.5944 | 15 | 23.36 |
| | 9.0 | 141 | 46 | 01.6 | 4 | 49 | 52.9 | 2.5818 | 15 | 27.84 |
| | 9.5 | 148 | 22 | 09.6 | 4 | 57 | 47.4 | 2.5697 | 15 | 32.23 |
| | 10.0 | 155 | 01 | 58.5 | 5 | 01 | 43.6 | 2.5580 | 15 | 36.50 |
| | 10.5 | 161 | 45 | 12.5 | 5 | 01 | 31.8 | 2.5468 | 15 | 40.60 |
| | 11.0 | 168 | 31 | 33.7 | +4 | 57 | 06.4 | 2.5363 | 15 | 44.49 |
| | 11.5 | 175 | 20 | 43.7 | 4 | 48 | 25.7 | 2.5265 | 15 | 48.15 |
| | 12.0 | 182 | 12 | 23.8 | 4 | 35 | 32.6 | 2.5174 | 15 | 51.57 |
| | 12.5 | 189 | 06 | 16.3 | 4 | 18 | 34.3 | 2.5091 | 15 | 54.74 |
| | 13.0 | 196 | 02 | 04.8 | 3 | 57 | 42.6 | 2.5015 | 15 | 57.64 |
| | 13.5 | 202 | 59 | 34.8 | 3 | 33 | 13.6 | 2.4946 | 16 | 00.29 |
| | 14.0 | 209 | 58 | 34.1 | +3 | 05 | 27.1 | 2.4884 | 16 | 02.66 |
| | 14.5 | 216 | 58 | 52.6 | 2 | 34 | 46.9 | 2.4830 | 16 | 04.76 |
| | 15.0 | 224 | 00 | 22.0 | 2 | 01 | 40.0 | 2.4783 | 16 | 06.59 |
| | 15.5 | 231 | 02 | 55.2 | 1 | 26 | 36.1 | 2.4744 | 16 | 08.12 |
| | 16.0 | 238 | 06 | 26.0 | +0 | 50 | 07.7 | 2.4713 | 16 | 09.33 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Longitude | | | Apparent Latitude | | | True Geocentric Distance (A. U.) | Semi Diameter | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | (X $10^{-3}$) | ' | " |
| Aug. | 16.0 | 238 | 06 | 26.0 | +0 | 50 | 07.7 | 2.4713 | 16 | 09.33 |
| | 16.5 | 245 | 10 | 47.7 | 0 | 12 | 48.8 | 2.4691 | 16 | 10.21 |
| | 17.0 | 252 | 15 | 52.6 | +0 | 24 | 45.1 | 2.4678 | 16 | 10.73 |
| | 17.5 | 259 | 21 | 31.2 | -1 | 01 | 57.6 | 2.4675 | 16 | 10.84 |
| | 18.0 | 266 | 27 | 30.8 | 1 | 38 | 12.6 | 2.4683 | 16 | 10.52 |
| | 18.5 | 273 | 33 | 35.7 | 2 | 12 | 54.5 | 2.4703 | 16 | 09.73 |
| | 19.0 | 280 | 39 | 26.4 | -2 | 45 | 29.3 | 2.4736 | 16 | 08.44 |
| | 19.5 | 287 | 44 | 39.4 | 3 | 15 | 25.3 | 2.4782 | 16 | 06.62 |
| | 20.0 | 294 | 48 | 47.9 | 3 | 42 | 14.2 | 2.4843 | 16 | 04.27 |
| | 20.5 | 301 | 51 | 22.0 | 4 | 05 | 31.5 | 2.4918 | 16 | 01.38 |
| | 21.0 | 308 | 51 | 49.9 | 4 | 24 | 57.5 | 2.5006 | 15 | 57.97 |
| | 21.5 | 315 | 49 | 38.9 | 4 | 40 | 17.4 | 2.5109 | 15 | 54.07 |
| | 22.0 | 322 | 44 | 16.9 | -4 | 51 | 22.0 | 2.5223 | 15 | 49.73 |
| | 22.5 | 329 | 35 | 13.8 | 4 | 58 | 07.2 | 2.535 | 15 | 45.00 |
| | 23.0 | 336 | 22 | 02.7 | 5 | 00 | 34.3 | 2.5485 | 15 | 39.96 |
| | 23.5 | 343 | 04 | 21.1 | 4 | 58 | 49.3 | 2.5629 | 15 | 34.71 |
| | 24.0 | 349 | 41 | 52.1 | 4 | 53 | 02.0 | 2.5777 | 15 | 29.32 |
| | 24.5 | 356 | 14 | 24.9 | 4 | 43 | 25.9 | 2.5928 | 15 | 23.91 |
| | 25.0 | 2 | 41 | 55.0 | -4 | 30 | 17.1 | 2.6079 | 15 | 18.56 |
| | 25.5 | 9 | 04 | 24.9 | 4 | 13 | 53.6 | 2.6227 | 15 | 13.37 |
| | 26.0 | 15 | 22 | 03.2 | 3 | 54 | 34.4 | 2.637 | 15 | 08.44 |
| | 26.5 | 21 | 35 | 05.0 | 3 | 32 | 39.4 | 2.6503 | 15 | 03.85 |
| | 27.0 | 27 | 43 | 50.6 | 3 | 08 | 28.6 | 2.6626 | 14 | 59.69 |
| | 27.5 | 33 | 48 | 45.6 | 2 | 42 | 21.6 | 2.6735 | 14 | 56.02 |
| | 28.0 | 39 | 50 | 19.8 | -2 | 14 | 37.8 | 2.6829 | 14 | 52.90 |
| | 28.5 | 45 | 49 | 06.6 | 1 | 45 | 35.9 | 2.6904 | 14 | 50.39 |
| | 29.0 | 51 | 45 | 42.3 | -1 | 15 | 34.0 | 2.6961 | 14 | 48.52 |
| | 29.5 | 57 | 40 | 45.7 | +0 | 44 | 49.8 | 2.6997 | 14 | 47.33 |
| | 30.0 | 63 | 34 | 57.0 | 0 | 13 | 40.5 | 2.7012 | 14 | 46.84 |
| | 30.5 | 69 | 28 | 57.5 | 0 | 17 | 36.9 | 2.7005 | 14 | 47.05 |
| | 31.0 | 75 | 23 | 28.7 | +0 | 48 | 45.4 | 2.6977 | 14 | 47.97 |
| | 31.5 | 81 | 19 | 12.0 | 1 | 19 | 28.1 | 2.6928 | 14 | 49.59 |
| Sept. | 1.0 | 87 | 16 | 47.9 | 1 | 49 | 27.4 | 2.6859 | 14 | 51.88 |
| | 1.5 | 93 | 16 | 55.1 | 2 | 18 | 25.5 | 2.6771 | 14 | 54.82 |
| | 2.0 | 99 | 20 | 10.5 | 2 | 46 | 03.7 | 2.6666 | 14 | 58.35 |
| | 2.5 | 105 | 27 | 07.4 | 3 | 12 | 03.0 | 2.6545 | 15 | 02.44 |
| | 3.0 | 111 | 38 | 15.7 | +3 | 36 | 03.3 | 2.6411 | 15 | 07.00 |
| | 3.5 | 117 | 54 | 00.8 | 3 | 57 | 44.4 | 2.6267 | 15 | 11.97 |
| | 4.0 | 124 | 14 | 42.5 | 4 | 16 | 45.6 | 2.6116 | 15 | 17.27 |
| | 4.5 | 130 | 40 | 34.8 | 4 | 32 | 46.5 | 2.596 | 15 | 22.79 |
| | 5.0 | 137 | 11 | 45.0 | 4 | 45 | 27.3 | 2.5802 | 15 | 28.44 |
| | 5.5 | 143 | 48 | 13.4 | 4 | 54 | 29.4 | 2.5645 | 15 | 34.10 |
| | 6.0 | 150 | 29 | 53.0 | +4 | 59 | 36.6 | 2.5493 | 15 | 39.69 |
| | 6.5 | 157 | 16 | 29.7 | 5 | 00 | 35.3 | 2.5348 | 15 | 45.07 |
| | 7.0 | 164 | 07 | 42.8 | 4 | 57 | 15.9 | 2.5212 | 15 | 50.16 |
| | 7.5 | 171 | 03 | 05.3 | 4 | 49 | 32.9 | 2.5087 | 15 | 54.87 |
| | 8.0 | 178 | 02 | 05.9 | +4 | 37 | 26.4 | 2.4977 | 15 | 59.11 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Longitude | | | Apparent Latitude | | | True Geocentric Distance (A. U.) | Semi Diameter | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | (X $10^{-3}$) | ' | " |
| Sept. | 8.0 | 178 | 02 | 05.9 | +4 | 37 | 26.4 | 2.4977 | 15 | 59.11 |
| | 8.5 | 185 | 04 | 09.4 | 4 | 21 | 01.6 | 2.4880 | 16 | 02.82 |
| | 9.0 | 192 | 08 | 39.1 | 4 | 00 | 29.7 | 2.4800 | 16 | 05.95 |
| | 9.5 | 199 | 14 | 57.5 | 3 | 36 | 07.4 | 2.4735 | 16 | 08.47 |
| | 10.0 | 206 | 22 | 28.7 | 3 | 08 | 16.8 | 2.4686 | 16 | 10.38 |
| | 10.5 | 213 | 30 | 39.2 | 2 | 37 | 24.4 | 2.4653 | 16 | 11.69 |
| | 11.0 | 220 | 38 | 59.0 | +2 | 04 | 00.9 | 2.4635 | 16 | 12.42 |
| | 11.5 | 227 | 47 | 02.3 | 1 | 28 | 39.6 | 2.4630 | 16 | 12.59 |
| | 12.0 | 234 | 54 | 27.9 | 0 | 51 | 56.2 | 2.4639 | 16 | 12.27 |
| | 12.5 | 242 | 00 | 58.9 | 0 | 14 | 27.2 | 2.4658 | 16 | 11.49 |
| | 13.0 | 249 | 06 | 22.6 | +0 | 23 | 10.6 | 2.4688 | 16 | 10.30 |
| | 13.5 | 256 | 10 | 29.4 | -1 | 00 | 20.9 | 2.4728 | 16 | 08.75 |
| | 14.0 | 263 | 13 | 12.4 | -1 | 36 | 28.7 | 2.4776 | 16 | 06.89 |
| | 14.5 | 270 | 14 | 26.3 | 2 | 11 | 00.5 | 2.4831 | 16 | 04.74 |
| | 15.0 | 277 | 14 | 06.4 | 2 | 43 | 25.7 | 2.4893 | 16 | 02.34 |
| | 15.5 | 284 | 12 | 07.7 | 3 | 13 | 15.7 | 2.4961 | 15 | 59.71 |
| | 16.0 | 291 | 08 | 24.5 | 3 | 40 | 05.6 | 2.5035 | 15 | 56.87 |
| | 16.5 | 298 | 02 | 49.4 | 4 | 03 | 33.6 | 2.5115 | 15 | 53.81 |
| | 17.0 | 304 | 55 | 13.3 | -4 | 23 | 21.7 | 2.5201 | 15 | 50.57 |
| | 17.5 | 311 | 45 | 25.4 | 4 | 39 | 15.8 | 2.5293 | 15 | 47.13 |
| | 18.0 | 318 | 33 | 12.8 | 4 | 51 | 05.9 | 2.5390 | 15 | 43.50 |
| | 18.5 | 325 | 18 | 21.5 | 4 | 58 | 46.2 | 2.5492 | 15 | 39.71 |
| | 19.0 | 332 | 00 | 36.8 | 5 | 02 | 15.2 | 2.5600 | 15 | 35.75 |
| | 19.5 | 338 | 39 | 43.9 | 5 | 01 | 35.4 | 2.5712 | 15 | 31.66 |
| | 20.0 | 345 | 15 | 28.6 | -4 | 56 | 53.2 | 2.5829 | 15 | 27.47 |
| | 20.5 | 351 | 47 | 38.5 | 4 | 48 | 18.4 | 2.5948 | 15 | 23.19 |
| | 21.0 | 358 | 16 | 03.3 | 4 | 36 | 03.9 | 2.6070 | 15 | 18.89 |
| | 21.5 | 4 | 40 | 36.1 | 4 | 20 | 25.5 | 2.6192 | 15 | 14.61 |
| | 22.0 | 11 | 01 | 13.4 | 4 | 01 | 40.6 | 2.6313 | 15 | 10.39 |
| | 22.5 | 17 | 17 | 55.8 | 3 | 40 | 08.5 | 2.6432 | 15 | 06.31 |
| | 23.0 | 23 | 30 | 48.3 | -3 | 16 | 09.4 | 2.6545 | 15 | 02.43 |
| | 23.5 | 29 | 40 | 00.4 | 2 | 50 | 03.9 | 2.6652 | 14 | 58.80 |
| | 24.0 | 35 | 45 | 46.1 | 2 | 22 | 12.8 | 2.6751 | 14 | 55.50 |
| | 24.5 | 41 | 48 | 23.6 | 1 | 52 | 56.8 | 2.6838 | 14 | 52.58 |
| | 25.0 | 47 | 48 | 15.2 | -1 | 22 | 36.0 | 2.6913 | 14 | 50.10 |
| | 25.5 | 53 | 45 | 47.0 | +0 | 51 | 29.9 | 2.6973 | 14 | 48.12 |
| | 26.0 | 59 | 41 | 28.6 | +0 | 19 | 57.6 | 2.7017 | 14 | 46.69 |
| | 26.5 | 65 | 35 | 52.6 | 0 | 11 | 42.7 | 2.7042 | 14 | 45.85 |
| | 27.0 | 71 | 29 | 34.2 | 0 | 43 | 13.3 | 2.7048 | 14 | 45.65 |
| | 27.5 | 77 | 23 | 10.5 | 1 | 14 | 17.0 | 2.7034 | 14 | 46.11 |
| | 28.0 | 83 | 17 | 20.5 | 1 | 44 | 36.7 | 2.6999 | 14 | 47.26 |
| | 28.5 | 89 | 12 | 44.4 | 2 | 13 | 55.7 | 2.6943 | 14 | 49.10 |
| | 29.0 | 95 | 10 | 02.7 | +2 | 41 | 56.9 | 2.6866 | 14 | 51.65 |
| | 29.5 | 101 | 09 | 56.0 | 3 | 08 | 23.2 | 2.6769 | 14 | 54.89 |
| | 30.0 | 107 | 13 | 04.1 | 3 | 32 | 57.1 | 2.6652 | 14 | 58.81 |
| | 30.5 | 113 | 20 | 05.4 | 3 | 55 | 20.5 | 2.6518 | 15 | 03.37 |
| Oct. | 1.0 | 119 | 31 | 35.8 | +4 | 15 | 15.0 | 2.6367 | 15 | 08.53 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Longitude | | | Apparent Latitude | | | True Geocentric Distance (A. U.) | Semi Diameter | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | (X $10^{-3}$) | ' | " |
| Oct. | 1.0 | 119 | 31 | 35.8 | +4 | 15 | 15.0 | 2.6367 | 15 | 08.53 |
| | 1.5 | 125 | 48 | 07.9 | 4 | 32 | 21.9 | 2.6203 | 15 | 14.22 |
| | 2.0 | 132 | 10 | 10.0 | 4 | 46 | 22.2 | 2.6028 | 15 | 20.37 |
| | 2.5 | 138 | 38 | 05.1 | 4 | 56 | 57.2 | 2.5845 | 15 | 26.89 |
| | 3.0 | 145 | 12 | 09.5 | 5 | 03 | 49.1 | 2.5657 | 15 | 33.66 |
| | 3.5 | 151 | 52 | 32.1 | 5 | 06 | 41.3 | 2.5469 | 15 | 40.56 |
| | 4.0 | 158 | 39 | 13.4 | +5 | 05 | 19.8 | 2.5284 | 15 | 47.44 |
| | 4.5 | 165 | 32 | 05.0 | 4 | 59 | 33.8 | 2.5106 | 15 | 54.18 |
| | 5.0 | 172 | 30 | 49.3 | 4 | 49 | 16.6 | 2.4938 | 16 | 00.61 |
| | 5.5 | 179 | 34 | 59.4 | 4 | 34 | 27.0 | 2.4784 | 16 | 06.57 |
| | 6.0 | 186 | 43 | 59.9 | 4 | 15 | 09.8 | 2.4647 | 16 | 11.94 |
| | 6.5 | 193 | 57 | 08.1 | 3 | 51 | 36.5 | 2.4530 | 16 | 16.58 |
| | 7.0 | 201 | 13 | 35.6 | +3 | 24 | 05.6 | 2.4435 | 16 | 20.37 |
| | 7.5 | 208 | 32 | 29.9 | 2 | 53 | 02.4 | 2.4363 | 16 | 23.25 |
| | 8.0 | 215 | 52 | 56.9 | 2 | 18 | 58.2 | 2.4316 | 16 | 25.16 |
| | 8.5 | 223 | 14 | 02.9 | 1 | 42 | 29.6 | 2.4293 | 16 | 26.09 |
| | 9.0 | 230 | 34 | 56.5 | 1 | 04 | 16.9 | 2.4294 | 16 | 26.05 |
| | 9.5 | 237 | 54 | 50.7 | 0 | 25 | 02.7 | 2.4318 | 16 | 25.09 |
| | 10.0 | 245 | 13 | 03.8 | +0 | 14 | 29.5 | 2.4362 | 16 | 23.29 |
| | 10.5 | 252 | 29 | 00.3 | +0 | 53 | 37.3 | 2.4425 | 16 | 20.75 |
| | 11.0 | 259 | 42 | 11.6 | -1 | 31 | 39.9 | 2.4505 | 16 | 17.56 |
| | 11.5 | 266 | 52 | 15.5 | 2 | 08 | 00.1 | 2.4598 | 16 | 13.85 |
| | 12.0 | 273 | 58 | 56.0 | 2 | 42 | 04.1 | 2.4703 | 16 | 09.73 |
| | 12.5 | 281 | 02 | 02.4 | 3 | 13 | 22.6 | 2.4817 | 16 | 05.29 |
| | 13.0 | 288 | 01 | 28.9 | -3 | 41 | 30.7 | 2.4936 | 16 | 00.65 |
| | 13.5 | 294 | 57 | 13.1 | 4 | 06 | 08.0 | 2.5061 | 15 | 55.89 |
| | 14.0 | 301 | 49 | 15.6 | 4 | 26 | 58.6 | 2.5187 | 15 | 51.08 |
| | 14.5 | 308 | 37 | 38.6 | 4 | 43 | 50.8 | 2.5315 | 15 | 46.28 |
| | 15.0 | 315 | 22 | 25.9 | 4 | 56 | 36.9 | 2.5443 | 15 | 41.54 |
| | 15.5 | 322 | 03 | 41.3 | 5 | 05 | 12.8 | 2.5569 | 15 | 36.88 |
| | 16.0 | 328 | 41 | 29.0 | -5 | 09 | 38.1 | 2.5694 | 15 | 32.33 |
| | 16.5 | 335 | 15 | 52.9 | 5 | 09 | 55.6 | 2.5816 | 15 | 27.92 |
| | 17.0 | 341 | 46 | 56.6 | 5 | 06 | 11.1 | 2.5936 | 15 | 23.64 |
| | 17.5 | 348 | 14 | 43.2 | 4 | 58 | 33.3 | 2.6053 | 15 | 19.50 |
| | 18.0 | 354 | 39 | 15.6 | 4 | 47 | 13.1 | 2.6166 | 15 | 15.50 |
| | 18.5 | 1 | 00 | 36.6 | 4 | 32 | 24.2 | 2.6277 | 15 | 11.66 |
| | 19.0 | 7 | 18 | 49.3 | -4 | 14 | 22.0 | 2.6383 | 15 | 07.97 |
| | 19.5 | 13 | 33 | 57.4 | 3 | 53 | 23.6 | 2.6486 | 15 | 04.45 |
| | 20.0 | 19 | 46 | 05.4 | 3 | 29 | 47.6 | 2.6584 | 15 | 01.11 |
| | 20.5 | 25 | 55 | 19.2 | 3 | 03 | 53.6 | 2.6677 | 14 | 57.96 |
| | 21.0 | 32 | 01 | 46.5 | 2 | 36 | 02.1 | 2.6765 | 14 | 55.04 |
| | 21.5 | 38 | 05 | 36.5 | 2 | 06 | 33.8 | 2.6845 | 14 | 52.36 |
| | 22.0 | 44 | 07 | 01.0 | -1 | 35 | 49.9 | 2.6917 | 14 | 49.96 |
| | 22.5 | 50 | 06 | 14.0 | -1 | 04 | 11.0 | 2.6980 | 14 | 47.88 |
| | 23.0 | 56 | 03 | 32.0 | +0 | 31 | 57.8 | 2.7033 | 14 | 46.16 |
| | 23.5 | 61 | 59 | 14.1 | 0 | 00 | 29.7 | 2.7073 | 14 | 44.83 |
| | 24.0 | 67 | 53 | 42.2 | +0 | 32 | 52.0 | 2.7101 | 14 | 43.94 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Longitude | | | Apparent Latitude | | | True Geocentric Distance (A. U.) | Semi Diameter | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | (X $10^{-3}$) | ' | " |
| Oct. | 24.0 | 67 | 53 | 42.2 | +0 | 32 | 52.0 | 2.7101 | 14 | 43.94 |
| | 24.5 | 73 | 47 | 20.4 | 1 | 04 | 50.4 | 2.7113 | 14 | 43.53 |
| | 25.0 | 79 | 40 | 35.8 | 1 | 36 | 06.5 | 2.7110 | 14 | 43.65 |
| | 25.5 | 85 | 33 | 57.6 | 2 | 06 | 22.9 | 2.7089 | 14 | 44.32 |
| | 26.0 | 91 | 27 | 57.0 | 2 | 35 | 22.4 | 2.7050 | 14 | 45.59 |
| | 26.5 | 97 | 23 | 07.4 | 3 | 02 | 48.4 | 2.6992 | 14 | 47.48 |
| | 27.0 | 103 | 20 | 03.8 | +3 | 28 | 24.6 | 2.6915 | 14 | 50.03 |
| | 27.5 | 109 | 19 | 22.2 | 3 | 51 | 54.7 | 2.6819 | 14 | 53.23 |
| | 28.0 | 115 | 21 | 39.5 | 4 | 13 | 02.4 | 2.6703 | 14 | 57.11 |
| | 28.5 | 121 | 27 | 32.7 | 4 | 31 | 31.7 | 2.6568 | 15 | 01.65 |
| | 29.0 | 127 | 37 | 38.5 | 4 | 47 | 06.2 | 2.6416 | 15 | 06.84 |
| | 29.5 | 133 | 52 | 32.1 | 4 | 59 | 29.7 | 2.6248 | 15 | 12.65 |
| | 30.0 | 140 | 12 | 46.6 | +5 | 08 | 26.3 | 2.6066 | 15 | 19.02 |
| | 30.5 | 146 | 38 | 51.8 | 5 | 13 | 40.2 | 2.5873 | 15 | 25.89 |
| | 31.0 | 153 | 11 | 13.1 | 5 | 14 | 57.1 | 2.5671 | 15 | 33.18 |
| | 31.5 | 159 | 50 | 10.3 | 5 | 12 | 03.7 | 2.5464 | 15 | 40.77 |
| Nov. | 1.0 | 166 | 35 | 56.3 | 5 | 04 | 49.5 | 2.5255 | 15 | 48.53 |
| | 1.5 | 173 | 28 | 36.0 | 4 | 53 | 07.0 | 2.5050 | 15 | 56.31 |
| | 2.0 | 180 | 28 | 05.0 | +4 | 36 | 53.0 | 2.4851 | 16 | 03.95 |
| | 2.5 | 187 | 34 | 09.0 | 4 | 16 | 09.7 | 2.4664 | 16 | 11.25 |
| | 3.0 | 194 | 46 | 23.0 | 3 | 51 | 05.8 | 2.4493 | 16 | 18.03 |
| | 3.5 | 202 | 04 | 12.0 | 3 | 21 | 57.0 | 2.4342 | 16 | 24.11 |
| | 4.0 | 209 | 26 | 50.9 | 2 | 49 | 06.6 | 2.4214 | 16 | 29.30 |
| | 4.5 | 216 | 53 | 26.0 | 2 | 13 | 05.3 | 2.4113 | 16 | 33.46 |
| | 5.0 | 224 | 22 | 56.9 | +1 | 34 | 30.8 | 2.4041 | 16 | 36.45 |
| | 5.5 | 231 | 54 | 18.2 | 0 | 54 | 06.6 | 2.3999 | 16 | 38.19 |
| | 6.0 | 239 | 26 | 22.4 | 0 | 12 | 40.4 | 2.3988 | 16 | 38.66 |
| | 6.5 | 246 | 58 | 02.5 | +0 | 28 | 58.3 | 2.4007 | 16 | 37.85 |
| | 7.0 | 254 | 28 | 14.2 | -1 | 09 | 59.8 | 2.4056 | 16 | 35.82 |
| | 7.5 | 261 | 55 | 58.2 | 1 | 49 | 36.5 | 2.4132 | 16 | 32.68 |
| | 8.0 | 269 | 20 | 22.2 | -2 | 27 | 04.8 | 2.4233 | 16 | 28.56 |
| | 8.5 | 276 | 40 | 41.9 | 3 | 01 | 46.6 | 2.4355 | 16 | 23.60 |
| | 9.0 | 283 | 56 | 22.0 | 3 | 33 | 09.6 | 2.4495 | 16 | 17.98 |
| | 9.5 | 291 | 06 | 55.7 | 4 | 00 | 48.4 | 2.4649 | 16 | 11.87 |
| | 10.0 | 298 | 12 | 05.3 | 4 | 24 | 24.0 | 2.4813 | 16 | 05.43 |
| | 10.5 | 305 | 11 | 41.0 | 4 | 43 | 43.6 | 2.4984 | 15 | 58.81 |
| | 11.0 | 312 | 05 | 40.1 | -4 | 58 | 40.0 | 2.5159 | 15 | 52.15 |
| | 11.5 | 318 | 54 | 06.2 | 5 | 09 | 11.0 | 2.5334 | 15 | 45.57 |
| | 12.0 | 325 | 37 | 07.8 | 5 | 15 | 18.4 | 2.5507 | 15 | 39.16 |
| | 12.5 | 332 | 14 | 57.3 | 5 | 17 | 07.7 | 2.5676 | 15 | 33.00 |
| | 13.0 | 338 | 47 | 50.3 | 5 | 14 | 47.0 | 2.5838 | 15 | 27.14 |
| | 13.5 | 345 | 16 | 04.1 | 5 | 08 | 26.9 | 2.5992 | 15 | 21.63 |
| | 14.0 | 351 | 39 | 57.5 | -4 | 58 | 19.9 | 2.6138 | 15 | 16.48 |
| | 14.5 | 357 | 59 | 49.7 | 4 | 44 | 40.1 | 2.6275 | 15 | 11.72 |
| | 15.0 | 4 | 16 | 00.1 | 4 | 27 | 42.7 | 2.6402 | 15 | 07.34 |
| | 15.5 | 10 | 28 | 47.8 | 4 | 07 | 44.3 | 2.6518 | 15 | 03.35 |
| | 16.0 | 16 | 38 | 31.2 | -3 | 45 | 02.2 | 2.6625 | 14 | 59.73 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Longitude | | | Apparent Latitude | | | True Geocentric Distance (A. U.) | Semi Diameter | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | (X $10^{-3}$) | | |
| | | ° | ' | " | ° | ' | " | | ' | " |
| Nov. | 16.0 | 16 | 38 | 31.2 | -3 | 45 | 02.2 | 2.6625 | 14 | 59.73 |
| | 16.5 | 22 | 45 | 28.1 | 3 | 19 | 54.7 | 2.6722 | 14 | 56.47 |
| | 17.0 | 28 | 49 | 55.6 | 2 | 52 | 40.6 | 2.6809 | 14 | 53.55 |
| | 17.5 | 34 | 52 | 09.8 | 2 | 23 | 39.6 | 2.6887 | 14 | 50.98 |
| | 18.0 | 40 | 52 | 26.4 | 1 | 53 | 11.5 | 2.6955 | 14 | 48.73 |
| | 18.5 | 46 | 51 | 00.6 | -1 | 21 | 36.6 | 2.7013 | 14 | 46.80 |
| | 19.0 | 52 | 48 | 07.5 | +0 | 49 | 15.2 | 2.7062 | 14 | 45.19 |
| | 19.5 | 58 | 44 | 01.9 | 0 | 16 | 27.8 | 2.7102 | 14 | 43.91 |
| | 20.0 | 64 | 38 | 59.0 | 0 | 16 | 25.5 | 2.7131 | 14 | 42.95 |
| | 20.5 | 70 | 33 | 14.6 | 0 | 49 | 04.5 | 2.7150 | 14 | 42.33 |
| | 21.0 | 76 | 27 | 05.1 | 1 | 21 | 09.7 | 2.7158 | 14 | 42.07 |
| | 21.5 | 82 | 20 | 47.9 | 1 | 52 | 22.2 | 2.7154 | 14 | 42.20 |
| | 22.0 | 88 | 14 | 41.7 | +2 | 22 | 23.4 | 2.7138 | 14 | 42.73 |
| | 22.5 | 94 | 09 | 06.5 | 2 | 50 | 55.6 | 2.7108 | 14 | 43.69 |
| | 23.0 | 100 | 04 | 23.9 | 3 | 17 | 41.6 | 2.7065 | 14 | 45.11 |
| | 23.5 | 106 | 00 | 57.0 | 3 | 42 | 25.0 | 2.7006 | 14 | 47.03 |
| | 24.0 | 111 | 59 | 10.5 | 4 | 04 | 50.1 | 2.6932 | 14 | 49.46 |
| | 24.5 | 117 | 59 | 30.8 | 4 | 24 | 41.7 | 2.6842 | 14 | 52.44 |
| | 25.0 | 124 | 02 | 25.5 | +4 | 41 | 45.4 | 2.6736 | 14 | 55.99 |
| | 25.5 | 130 | 08 | 23.8 | 4 | 55 | 47.2 | 2.6613 | 15 | 00.12 |
| | 26.0 | 136 | 17 | 55.4 | 5 | 06 | 33.7 | 2.6475 | 15 | 04.84 |
| | 26.5 | 142 | 31 | 30.7 | 5 | 13 | 52.3 | 2.6320 | 15 | 10.14 |
| | 27.0 | 148 | 49 | 39.9 | 5 | 17 | 31.1 | 2.6152 | 15 | 16.02 |
| | 27.5 | 155 | 12 | 52.5 | 5 | 17 | 19.2 | 2.5970 | 15 | 22.42 |
| | 28.0 | 161 | 41 | 36.3 | +5 | 13 | 07.0 | 2.5777 | 15 | 29.32 |
| | 28.5 | 168 | 16 | 16.6 | 5 | 04 | 46.7 | 2.5576 | 15 | 36.63 |
| | 29.0 | 174 | 57 | 14.8 | 4 | 52 | 12.9 | 2.5369 | 15 | 44.27 |
| | 29.5 | 181 | 44 | 47.5 | 4 | 35 | 23.4 | 2.5160 | 15 | 52.11 |
| | 30.0 | 188 | 39 | 04.7 | 4 | 14 | 19.7 | 2.4953 | 16 | 00.02 |
| | 30.5 | 195 | 40 | 09.2 | 3 | 49 | 08.2 | 2.4751 | 16 | 07.83 |
| Dec. | 1.0 | 202 | 47 | 54.6 | +3 | 20 | 01.2 | 2.4560 | 16 | 15.37 |
| | 1.5 | 210 | 02 | 04.9 | 2 | 47 | 17.3 | 2.4384 | 16 | 22.44 |
| | 2.0 | 217 | 22 | 13.1 | 2 | 11 | 22.0 | 2.4226 | 16 | 28.82 |
| | 2.5 | 224 | 47 | 41.6 | 1 | 32 | 48.3 | 2.4092 | 16 | 34.33 |
| | 3.0 | 232 | 17 | 42.0 | 0 | 52 | 15.5 | 2.3985 | 16 | 38.78 |
| | 3.5 | 239 | 51 | 16.2 | 0 | 10 | 29.0 | 2.3907 | 16 | 42.01 |
| | 4.0 | 247 | 27 | 17.7 | +0 | 31 | 41.3 | 2.3862 | 16 | 43.90 |
| | 4.5 | 255 | 04 | 34.3 | -1 | 13 | 23.7 | 2.3851 | 16 | 44.39 |
| | 5.0 | 262 | 41 | 50.4 | 1 | 53 | 46.2 | 2.3873 | 16 | 43.45 |
| | 5.5 | 270 | 17 | 50.0 | 2 | 31 | 59.4 | 2.3928 | 16 | 41.13 |
| | 6.0 | 277 | 51 | 20.0 | 3 | 07 | 18.4 | 2.4015 | 16 | 37.52 |
| | 6.5 | 285 | 21 | 12.8 | 3 | 39 | 05.1 | 2.4130 | 16 | 32.75 |
| | 7.0 | 292 | 46 | 28.6 | -4 | 06 | 48.8 | 2.4271 | 16 | 27.00 |
| | 7.5 | 300 | 06 | 17.5 | 4 | 30 | 07.0 | 2.4433 | 16 | 20.44 |
| | 8.0 | 307 | 20 | 00.6 | 4 | 48 | 45.7 | 2.4612 | 16 | 13.30 |
| | 8.5 | 314 | 27 | 10.3 | 5 | 02 | 38.1 | 2.4805 | 16 | 05.76 |
| | 9.0 | 321 | 27 | 30.1 | -5 | 11 | 44.4 | 2.5005 | 15 | 58.01 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Longitude | | | Apparent Latitude | | | True Geocentric Distance (A. U.) | Semi Diameter | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | (X $10^{-3}$) | ' | " |
| Dec. | 9.0 | 321 | 27 | 30.1 | -5 | 11 | 44.4 | 2.5005 | 15 | 58.01 |
| | 9.5 | 328 | 20 | 53.9 | 5 | 16 | 10.1 | 2.5210 | 15 | 50.22 |
| | 10.0 | 335 | 07 | 25.1 | 5 | 16 | 05.3 | 2.5415 | 15 | 42.56 |
| | 10.5 | 341 | 47 | 15.2 | 5 | 11 | 43.3 | 2.5617 | 15 | 35.13 |
| | 11.0 | 348 | 20 | 42.1 | 5 | 03 | 19.8 | 2.5812 | 15 | 28.05 |
| | 11.5 | 354 | 48 | 09.1 | 4 | 51 | 12.0 | 2.5999 | 15 | 21.40 |
| | 12.0 | 1 | 10 | 03.4 | -4 | 35 | 38.3 | 2.6174 | 15 | 15.23 |
| | 12.5 | 7 | 26 | 54.8 | 4 | 16 | 57.3 | 2.6336 | 15 | 09.59 |
| | 13.0 | 13 | 39 | 14.5 | 3 | 55 | 28.0 | 2.6484 | 15 | 04.50 |
| | 13.5 | 19 | 47 | 34.7 | 3 | 31 | 29.4 | 2.6618 | 14 | 59.97 |
| | 14.0 | 25 | 52 | 27.0 | 3 | 05 | 20.4 | 2.6736 | 14 | 55.99 |
| | 14.5 | 31 | 54 | 22.9 | 2 | 37 | 20.2 | 2.6839 | 14 | 52.57 |
| | 15.0 | 37 | 53 | 52.2 | -2 | 07 | 47.6 | 2.6926 | 14 | 49.67 |
| | 15.5 | 43 | 51 | 23.5 | 1 | 37 | 01.6 | 2.6999 | 14 | 47.27 |
| | 16.0 | 49 | 47 | 23.5 | -1 | 05 | 21.3 | 2.7057 | 14 | 45.36 |
| | 16.5 | 55 | 42 | 17.1 | +0 | 33 | 05.8 | 2.7102 | 14 | 43.90 |
| | 17.0 | 61 | 36 | 27.2 | 0 | 00 | 34.3 | 2.7133 | 14 | 42.87 |
| | 17.5 | 67 | 30 | 14.9 | 0 | 31 | 53.9 | 2.7153 | 14 | 42.24 |
| | 18.0 | 73 | 23 | 59.4 | +1 | 03 | 59.5 | 2.7161 | 14 | 41.99 |
| | 18.5 | 79 | 17 | 58.2 | 1 | 35 | 23.4 | 2.7157 | 14 | 42.10 |
| | 19.0 | 85 | 12 | 27.4 | 2 | 05 | 46.4 | 2.7143 | 14 | 42.55 |
| | 19.5 | 91 | 07 | 41.9 | 2 | 34 | 50.0 | 2.7119 | 14 | 43.34 |
| | 20.0 | 97 | 03 | 55.7 | 3 | 02 | 15.8 | 2.7084 | 14 | 44.47 |
| | 20.5 | 103 | 01 | 22.3 | 3 | 27 | 46.3 | 2.7040 | 14 | 45.92 |
| | 21.0 | 109 | 00 | 14.7 | +3 | 51 | 04.5 | 2.6985 | 14 | 47.72 |
| | 21.5 | 115 | 00 | 46.2 | 4 | 11 | 54.6 | 2.6920 | 14 | 49.86 |
| | 22.0 | 121 | 03 | 10.5 | 4 | 30 | 01.6 | 2.6845 | 14 | 52.36 |
| | 22.5 | 127 | 07 | 41.7 | 4 | 45 | 11.5 | 2.6759 | 14 | 55.24 |
| | 23.0 | 133 | 14 | 35.0 | 4 | 57 | 12.0 | 2.6661 | 14 | 58.50 |
| | 23.5 | 139 | 24 | 06.9 | 5 | 05 | 51.5 | 2.6553 | 15 | 02.18 |
| | 24.0 | 145 | 36 | 34.8 | +5 | 11 | 00.3 | 2.6432 | 15 | 06.28 |
| | 24.5 | 151 | 52 | 17.4 | 5 | 12 | 29.8 | 2.6301 | 15 | 10.82 |
| | 25.0 | 158 | 11 | 34.6 | 5 | 10 | 13.4 | 2.6158 | 15 | 15.78 |
| | 25.5 | 164 | 34 | 47.2 | 5 | 04 | 05.9 | 2.6005 | 15 | 21.18 |
| | 26.0 | 171 | 02 | 16.4 | 4 | 54 | 04.2 | 2.5842 | 15 | 26.99 |
| | 26.5 | 177 | 34 | 23.7 | 4 | 40 | 07.5 | 2.5671 | 15 | 33.18 |
| | 27.0 | 184 | 11 | 29.6 | +4 | 22 | 17.5 | 2.5493 | 15 | 39.69 |
| | 27.5 | 190 | 53 | 53.2 | 4 | 00 | 39.2 | 2.5310 | 15 | 46.48 |
| | 28.0 | 197 | 41 | 51.0 | 3 | 35 | 20.7 | 2.5125 | 15 | 53.43 |
| | 28.5 | 204 | 35 | 35.7 | 3 | 06 | 34.6 | 2.4942 | 16 | 00.46 |
| | 29.0 | 211 | 35 | 14.9 | 2 | 34 | 37.9 | 2.4762 | 16 | 07.42 |
| | 29.5 | 218 | 40 | 49.7 | 1 | 59 | 52.7 | 2.4591 | 16 | 14.16 |
| | 30.0 | 225 | 52 | 13.2 | +1 | 22 | 46.8 | 2.4431 | 16 | 20.51 |
| | 30.5 | 233 | 09 | 09.8 | 0 | 43 | 53.1 | 2.4288 | 16 | 26.31 |
| | 31.0 | 240 | 31 | 13.3 | 0 | 03 | 50.3 | 2.4164 | 16 | 31.35 |
| | 31.5 | 247 | 57 | 47.2 | +0 | 36 | 38.7 | 2.4064 | 16 | 35.48 |
| | 32.0 | 255 | 28 | 04.1 | -1 | 16 | 47.3 | 2.3990 | 16 | 38.53 |

**MOON, 2021**
FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | Horizontal Parallax | |
|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | ' | " |
| Jan. | 0.0 | 7 | 27 | 14.98 | +24 | 34 | 14.71 | 56 | 14.78 |
| | 0.5 | 7 | 55 | 27.71 | 23 | 57 | 40.87 | 56 | 29.54 |
| | 1.0 | 8 | 23 | 33.98 | 23 | 01 | 27.48 | 56 | 44.20 |
| | 1.5 | 8 | 51 | 26.22 | 21 | 46 | 14.72 | 56 | 58.68 |
| | 2.0 | 9 | 18 | 58.56 | 20 | 13 | 04.61 | 57 | 12.90 |
| | 2.5 | 9 | 46 | 07.23 | 18 | 23 | 17.43 | 57 | 26.83 |
| | 3.0 | 10 | 12 | 50.63 | +16 | 18 | 27.54 | 57 | 40.45 |
| | 3.5 | 10 | 39 | 09.27 | 14 | 00 | 19.53 | 57 | 53.73 |
| | 4.0 | 11 | 05 | 05.59 | 11 | 30 | 44.88 | 58 | 06.67 |
| | 4.5 | 11 | 30 | 43.62 | 8 | 51 | 39.64 | 58 | 19.22 |
| | 5.0 | 11 | 56 | 08.75 | 6 | 05 | 03.03 | 58 | 31.36 |
| | 5.5 | 12 | 21 | 27.37 | 3 | 12 | 57.00 | 58 | 43.02 |
| | 6.0 | 12 | 46 | 46.61 | +0 | 17 | 26.64 | 58 | 54.11 |
| | 6.5 | 13 | 12 | 14.08 | -2 | 39 | 18.91 | 59 | 04.51 |
| | 7.0 | 13 | 37 | 57.56 | 5 | 35 | 05.24 | 59 | 14.04 |
| | 7.5 | 14 | 04 | 04.73 | 8 | 27 | 31.39 | 59 | 22.51 |
| | 8.0 | 14 | 30 | 42.79 | 11 | 14 | 09.14 | 59 | 29.69 |
| | 8.5 | 14 | 57 | 58.02 | 13 | 52 | 22.93 | 59 | 35.34 |
| | 9.0 | 15 | 25 | 55.23 | -16 | 19 | 31.24 | 59 | 39.19 |
| | 9.5 | 15 | 54 | 37.18 | 18 | 32 | 49.68 | 59 | 40.99 |
| | 10.0 | 16 | 24 | 03.90 | 20 | 29 | 36.21 | 59 | 40.52 |
| | 10.5 | 16 | 54 | 12.19 | 22 | 07 | 18.56 | 59 | 37.57 |
| | 11.0 | 17 | 24 | 55.25 | 23 | 23 | 43.38 | 59 | 32.03 |
| | 11.5 | 17 | 56 | 02.86 | 24 | 17 | 06.13 | 59 | 23.81 |
| | 12.0 | 18 | 27 | 21.92 | -24 | 46 | 20.06 | 59 | 12.95 |
| | 12.5 | 18 | 58 | 37.57 | 24 | 51 | 02.50 | 58 | 59.55 |
| | 13.0 | 19 | 29 | 34.66 | 24 | 31 | 37.01 | 58 | 43.79 |
| | 13.5 | 19 | 59 | 59.24 | 23 | 49 | 10.62 | 58 | 25.97 |
| | 14.0 | 20 | 29 | 39.78 | 22 | 45 | 26.85 | 58 | 06.41 |
| | 14.5 | 20 | 58 | 27.97 | 21 | 22 | 35.89 | 57 | 45.51 |
| | 15.0 | 21 | 26 | 18.99 | -19 | 43 | 03.84 | 57 | 23.70 |
| | 15.5 | 21 | 53 | 11.30 | 17 | 49 | 22.67 | 57 | 01.44 |
| | 16.0 | 22 | 19 | 06.20 | 15 | 44 | 02.13 | 56 | 39.17 |
| | 16.5 | 22 | 44 | 07.19 | 13 | 29 | 23.91 | 56 | 17.33 |
| | 17.0 | 23 | 08 | 19.40 | 11 | 07 | 38.23 | 55 | 56.34 |
| | 17.5 | 23 | 31 | 49.03 | 8 | 40 | 42.32 | 55 | 36.58 |
| | 18.0 | 23 | 54 | 42.96 | -6 | 10 | 20.42 | 55 | 18.38 |
| | 18.5 | 0 | 17 | 08.42 | 3 | 38 | 04.83 | 55 | 02.04 |
| | 19.0 | 0 | 39 | 12.79 | -1 | 05 | 17.67 | 54 | 47.80 |
| | 19.5 | 1 | 01 | 03.45 | +1 | 26 | 47.12 | 54 | 35.87 |
| | 20.0 | 1 | 22 | 47.72 | 3 | 57 | 01.45 | 54 | 26.40 |
| | 20.5 | 1 | 44 | 32.75 | 6 | 24 | 20.86 | 54 | 19.50 |
| | 21.0 | 2 | 06 | 25.49 | +8 | 47 | 42.26 | 54 | 15.24 |
| | 21.5 | 2 | 28 | 32.64 | 11 | 06 | 01.93 | 54 | 13.65 |
| | 22.0 | 2 | 51 | 00.57 | 13 | 18 | 13.64 | 54 | 14.70 |
| | 22.5 | 3 | 13 | 55.17 | 15 | 23 | 07.09 | 54 | 18.35 |
| | 23.0 | 3 | 37 | 21.69 | +17 | 19 | 26.86 | 54 | 24.51 |

**MOON, 2021**
FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | Horizontal Parallax | |
|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | ' | " |
| Jan. | 23.0 | 3 | 37 | 21.69 | +17 | 19 | 26.86 | 54 | 24.51 |
| | 23.5 | 4 | 01 | 24.55 | 19 | 05 | 51.82 | 54 | 33.04 |
| | 24.0 | 4 | 26 | 07.07 | 20 | 40 | 55.31 | 54 | 43.78 |
| | 24.5 | 4 | 51 | 31.13 | 22 | 03 | 06.33 | 54 | 56.54 |
| | 25.0 | 5 | 17 | 36.92 | 23 | 10 | 51.67 | 55 | 11.07 |
| | 25.5 | 5 | 44 | 22.69 | 24 | 02 | 39.35 | 55 | 27.12 |
| | 26.0 | 6 | 11 | 44.58 | +24 | 37 | 03.04 | 55 | 44.39 |
| | 26.5 | 6 | 39 | 36.72 | 24 | 52 | 47.26 | 56 | 02.56 |
| | 27.0 | 7 | 07 | 51.50 | 24 | 48 | 52.92 | 56 | 21.31 |
| | 27.5 | 7 | 36 | 20.08 | 24 | 24 | 42.35 | 56 | 40.28 |
| | 28.0 | 8 | 04 | 53.12 | 23 | 40 | 03.12 | 56 | 59.15 |
| | 28.5 | 8 | 33 | 21.57 | 22 | 35 | 10.25 | 57 | 17.58 |
| | 29.0 | 9 | 01 | 37.43 | +21 | 10 | 46.19 | 57 | 35.26 |
| | 29.5 | 9 | 29 | 34.37 | 19 | 27 | 59.06 | 57 | 51.91 |
| | 30.0 | 9 | 57 | 08.16 | 17 | 28 | 19.23 | 58 | 07.30 |
| | 30.5 | 10 | 24 | 16.76 | 15 | 13 | 35.13 | 58 | 21.24 |
| | 31.0 | 10 | 51 | 00.31 | 12 | 45 | 48.75 | 58 | 33.60 |
| | 31.5 | 11 | 17 | 20.91 | 10 | 07 | 11.47 | 58 | 44.29 |
| Feb. | 1.0 | 11 | 43 | 22.31 | +7 | 20 | 00.52 | 58 | 53.28 |
| | 1.5 | 12 | 09 | 09.59 | 4 | 26 | 36.38 | 59 | 00.60 |
| | 2.0 | 12 | 34 | 48.83 | +1 | 29 | 20.94 | 59 | 06.29 |
| | 2.5 | 13 | 00 | 26.77 | -1 | 29 | 23.39 | 59 | 10.43 |
| | 3.0 | 13 | 26 | 10.56 | 4 | 27 | 14.05 | 59 | 13.13 |
| | 3.5 | 13 | 52 | 07.41 | 7 | 21 | 48.14 | 59 | 14.49 |
| | 4.0 | 14 | 18 | 24.29 | -10 | 10 | 42.15 | 59 | 14.60 |
| | 4.5 | 14 | 45 | 07.58 | 12 | 51 | 31.78 | 59 | 13.54 |
| | 5.0 | 15 | 12 | 22.64 | 15 | 21 | 52.30 | 59 | 11.39 |
| | 5.5 | 15 | 40 | 13.33 | 17 | 39 | 19.78 | 59 | 08.17 |
| | 6.0 | 16 | 08 | 41.53 | 19 | 41 | 33.57 | 59 | 03.90 |
| | 6.5 | 16 | 37 | 46.68 | 21 | 26 | 20.19 | 58 | 58.57 |
| | 7.0 | 17 | 07 | 25.34 | -22 | 51 | 38.77 | 58 | 52.16 |
| | 7.5 | 17 | 37 | 31.14 | 23 | 55 | 47.47 | 58 | 44.61 |
| | 8.0 | 18 | 07 | 54.95 | 24 | 37 | 30.37 | 58 | 35.90 |
| | 8.5 | 18 | 38 | 25.45 | 24 | 56 | 03.44 | 58 | 25.99 |
| | 9.0 | 19 | 08 | 50.10 | 24 | 51 | 18.70 | 58 | 14.86 |
| | 9.5 | 19 | 38 | 56.28 | 24 | 23 | 45.28 | 58 | 02.53 |
| | 10.0 | 20 | 08 | 32.48 | -23 | 34 | 27.34 | 57 | 49.03 |
| | 10.5 | 20 | 37 | 29.17 | 22 | 24 | 58.91 | 57 | 34.46 |
| | 11.0 | 21 | 05 | 39.50 | 20 | 57 | 16.78 | 57 | 18.93 |
| | 11.5 | 21 | 32 | 59.42 | 19 | 13 | 32.60 | 57 | 02.62 |
| | 12.0 | 21 | 59 | 27.61 | 17 | 16 | 05.19 | 56 | 45.71 |
| | 12.5 | 22 | 25 | 05.10 | 15 | 07 | 14.10 | 56 | 28.45 |
| | 13.0 | 22 | 49 | 54.86 | -12 | 49 | 14.61 | 56 | 11.09 |
| | 13.5 | 23 | 14 | 01.24 | 10 | 24 | 14.38 | 55 | 53.93 |
| | 14.0 | 23 | 37 | 29.66 | 7 | 54 | 11.51 | 55 | 37.25 |
| | 14.5 | 0 | 00 | 26.15 | 5 | 20 | 53.88 | 55 | 21.34 |
| | 15.0 | 0 | 22 | 57.15 | -2 | 45 | 59.35 | 55 | 06.49 |

**MOON, 2021**
FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | Horizontal Parallax | |
|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | ' | " |
| Feb. | 15.0 | 0 | 22 | 57.15 | -2 | 45 | 59.35 | 55 | 06.49 |
| | 15.5 | 0 | 45 | 09.30 | +0 | 10 | 56.60 | 54 | 52.98 |
| | 16.0 | 1 | 07 | 09.30 | 2 | 22 | 53.50 | 54 | 41.07 |
| | 16.5 | 1 | 29 | 03.82 | 4 | 54 | 16.35 | 54 | 30.99 |
| | 17.0 | 1 | 50 | 59.43 | 7 | 22 | 01.86 | 54 | 22.96 |
| | 17.5 | 2 | 13 | 02.53 | 9 | 45 | 02.66 | 54 | 17.15 |
| | 18.0 | 2 | 35 | 19.29 | +12 | 02 | 12.35 | 54 | 13.73 |
| | 18.5 | 2 | 57 | 55.59 | 14 | 12 | 23.88 | 54 | 12.80 |
| | 19.0 | 3 | 20 | 56.86 | 16 | 14 | 28.15 | 54 | 14.44 |
| | 19.5 | 3 | 44 | 27.96 | 18 | 07 | 12.85 | 54 | 18.72 |
| | 20.0 | 4 | 08 | 32.97 | 19 | 49 | 21.87 | 54 | 25.64 |
| | 20.5 | 4 | 33 | 14.98 | 21 | 19 | 35.23 | 54 | 35.17 |
| | 21.0 | 4 | 58 | 35.79 | +22 | 36 | 29.73 | 54 | 47.23 |
| | 21.5 | 5 | 24 | 35.72 | 23 | 38 | 40.65 | 55 | 01.70 |
| | 22.0 | 5 | 51 | 13.36 | 24 | 24 | 44.25 | 55 | 18.43 |
| | 22.5 | 6 | 18 | 25.49 | 24 | 53 | 21.33 | 55 | 37.18 |
| | 23.0 | 6 | 46 | 07.09 | 25 | 03 | 21.54 | 55 | 57.70 |
| | 23.5 | 7 | 14 | 11.64 | 24 | 53 | 48.05 | 56 | 19.65 |
| | 24.0 | 7 | 42 | 31.50 | +24 | 24 | 02.19 | 56 | 42.68 |
| | 24.5 | 8 | 10 | 58.51 | 23 | 33 | 47.29 | 57 | 06.35 |
| | 25.0 | 8 | 39 | 24.72 | 22 | 23 | 11.56 | 57 | 30.22 |
| | 25.5 | 9 | 07 | 43.02 | 20 | 52 | 49.27 | 57 | 53.78 |
| | 26.0 | 9 | 35 | 47.70 | 19 | 03 | 40.61 | 58 | 16.55 |
| | 26.5 | 10 | 03 | 34.87 | 16 | 57 | 09.99 | 58 | 38.02 |
| | 27.0 | 10 | 31 | 02.58 | +14 | 35 | 03.51 | 58 | 57.73 |
| | 27.5 | 10 | 58 | 10.87 | 11 | 59 | 25.62 | 59 | 15.23 |
| | 28.0 | 11 | 25 | 01.55 | 9 | 12 | 35.74 | 59 | 30.16 |
| | 28.5 | 11 | 51 | 38.02 | 6 | 17 | 04.69 | 59 | 42.25 |
| Mar. | 1.0 | 12 | 18 | 04.89 | 3 | 15 | 31.58 | 59 | 51.30 |
| | 1.5 | 12 | 44 | 27.70 | +0 | 10 | 40.84 | 59 | 57.23 |
| | 2.0 | 13 | 10 | 52.54 | -2 | 54 | 40.22 | 60 | 00.06 |
| | 2.5 | 13 | 37 | 25.78 | 5 | 57 | 43.61 | 59 | 59.91 |
| | 3.0 | 14 | 04 | 13.66 | 8 | 55 | 42.45 | 59 | 56.96 |
| | 3.5 | 14 | 31 | 21.94 | 11 | 45 | 52.69 | 59 | 51.48 |
| | 4.0 | 14 | 58 | 55.50 | 14 | 25 | 34.91 | 59 | 43.78 |
| | 4.5 | 15 | 26 | 57.87 | 16 | 52 | 16.31 | 59 | 34.19 |
| | 5.0 | 15 | 55 | 30.86 | -19 | 03 | 33.30 | 59 | 23.03 |
| | 5.5 | 16 | 24 | 34.08 | 20 | 57 | 14.78 | 59 | 10.63 |
| | 6.0 | 16 | 54 | 04.69 | 22 | 31 | 26.16 | 58 | 57.28 |
| | 6.5 | 17 | 23 | 57.28 | 23 | 44 | 33.81 | 58 | 43.24 |
| | 7.0 | 17 | 54 | 04.06 | 24 | 35 | 29.64 | 58 | 28.72 |
| | 7.5 | 18 | 24 | 15.36 | 25 | 03 | 34.87 | 58 | 13.90 |
| | 8.0 | 18 | 54 | 20.37 | -25 | 08 | 42.37 | 57 | 58.91 |
| | 8.5 | 19 | 24 | 08.13 | 24 | 51 | 16.97 | 57 | 43.86 |
| | 9.0 | 19 | 53 | 28.47 | 24 | 12 | 13.34 | 57 | 28.80 |
| | 9.5 | 20 | 22 | 12.84 | 23 | 12 | 51.97 | 57 | 13.79 |
| | 10.0 | 20 | 50 | 14.84 | -21 | 54 | 53.62 | 56 | 58.85 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension h | m | s | Apparent Declination ° | ' | " | Horizontal Parallax ' | " |
|---|---|---|---|---|---|---|---|---|---|
| Mar. | 10.0 | 20 | 50 | 14.84 | -21 | 54 | 53.62 | 56 | 58.85 |
| | 10.5 | 21 | 17 | 30.51 | 20 | 20 | 13.22 | 56 | 44.02 |
| | 11.0 | 21 | 43 | 58.22 | 18 | 30 | 53.99 | 56 | 29.32 |
| | 11.5 | 22 | 09 | 38.50 | 16 | 29 | 02.26 | 56 | 14.79 |
| | 12.0 | 22 | 34 | 33.62 | 14 | 16 | 43.43 | 56 | 00.47 |
| | 12.5 | 22 | 58 | 47.24 | 11 | 55 | 59.05 | 55 | 46.42 |
| | 13.0 | 23 | 22 | 24.01 | -9 | 28 | 44.97 | 55 | 32.74 |
| | 13.5 | 23 | 45 | 29.27 | 6 | 56 | 50.32 | 55 | 19.52 |
| | 14.0 | 0 | 08 | 08.76 | 4 | 21 | 57.24 | 55 | 06.90 |
| | 14.5 | 0 | 30 | 28.48 | -1 | 45 | 41.03 | 54 | 55.01 |
| | 15.0 | 0 | 52 | 34.52 | +0 | 50 | 29.24 | 54 | 44.02 |
| | 15.5 | 1 | 14 | 32.95 | 3 | 25 | 09.97 | 54 | 34.08 |
| | 16.0 | 1 | 36 | 29.75 | +5 | 57 | 02.06 | 54 | 25.39 |
| | 16.5 | 1 | 58 | 30.78 | 8 | 24 | 49.86 | 54 | 18.13 |
| | 17.0 | 2 | 20 | 41.66 | 10 | 47 | 20.06 | 54 | 12.47 |
| | 17.5 | 2 | 43 | 07.74 | 13 | 03 | 20.63 | 54 | 08.59 |
| | 18.0 | 3 | 05 | 54.00 | 15 | 11 | 39.84 | 54 | 06.66 |
| | 18.5 | 3 | 29 | 04.93 | 17 | 11 | 05.42 | 54 | 06.83 |
| | 19.0 | 3 | 52 | 44.38 | +19 | 00 | 23.98 | 54 | 09.25 |
| | 19.5 | 4 | 16 | 55.43 | 20 | 38 | 20.77 | 54 | 14.02 |
| | 20.0 | 4 | 41 | 40.12 | 22 | 03 | 39.96 | 54 | 21.23 |
| | 20.5 | 5 | 06 | 59.37 | 23 | 15 | 05.34 | 54 | 30.94 |
| | 21.0 | 5 | 32 | 52.71 | 24 | 11 | 21.85 | 54 | 43.18 |
| | 21.5 | 5 | 59 | 18.27 | 24 | 51 | 17.54 | 54 | 57.93 |
| | 22.0 | 6 | 26 | 12.70 | +25 | 13 | 46.30 | 55 | 15.13 |
| | 22.5 | 6 | 53 | 31.35 | 25 | 17 | 50.87 | 55 | 34.67 |
| | 23.0 | 7 | 21 | 08.49 | 25 | 02 | 46.07 | 55 | 56.37 |
| | 23.5 | 7 | 48 | 57.79 | 24 | 28 | 01.87 | 56 | 20.00 |
| | 24.0 | 8 | 16 | 52.72 | 23 | 33 | 26.02 | 56 | 45.26 |
| | 24.5 | 8 | 44 | 47.18 | 22 | 19 | 05.95 | 57 | 11.78 |
| | 25.0 | 9 | 12 | 35.93 | +20 | 45 | 29.94 | 57 | 39.11 |
| | 25.5 | 9 | 40 | 15.06 | 18 | 53 | 27.52 | 58 | 06.74 |
| | 26.0 | 10 | 07 | 42.18 | 16 | 44 | 09.20 | 58 | 34.09 |
| | 26.5 | 10 | 34 | 56.59 | 14 | 19 | 05.78 | 59 | 00.56 |
| | 27.0 | 11 | 01 | 59.25 | 11 | 40 | 07.37 | 59 | 25.50 |
| | 27.5 | 11 | 28 | 52.63 | 8 | 49 | 22.13 | 59 | 48.26 |
| | 28.0 | 11 | 55 | 40.51 | +5 | 49 | 14.85 | 60 | 08.23 |
| | 28.5 | 12 | 22 | 27.72 | 2 | 42 | 25.26 | 60 | 24.87 |
| | 29.0 | 12 | 49 | 19.81 | +0 | 28 | 14.05 | 60 | 37.71 |
| | 29.5 | 13 | 16 | 22.78 | -3 | 39 | 40.05 | 60 | 46.44 |
| | 30.0 | 13 | 43 | 42.63 | 6 | 48 | 42.33 | 60 | 50.87 |
| | 30.5 | 14 | 11 | 25.01 | 9 | 52 | 06.55 | 60 | 50.97 |
| | 31.0 | 14 | 39 | 34.73 | -12 | 46 | 38.55 | 60 | 46.89 |
| | 31.5 | 15 | 08 | 15.25 | 15 | 29 | 09.04 | 60 | 38.87 |
| Apr. | 1.0 | 15 | 37 | 28.21 | 17 | 56 | 38.75 | 60 | 27.32 |
| | 1.5 | 16 | 07 | 12.87 | 20 | 06 | 24.26 | 60 | 12.70 |
| | 2.0 | 16 | 37 | 25.84 | -21 | 56 | 03.96 | 59 | 55.54 |

**MOON, 2021**
FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | Horizontal Parallax | |
|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | ' | " |
| Apr. | 1.0 | 15 | 37 | 28.21 | -17 | 56 | 38.75 | 60 | 27.32 |
| | 1.5 | 16 | 07 | 12.87 | 20 | 06 | 24.26 | 60 | 12.70 |
| | 2.0 | 16 | 37 | 25.84 | 21 | 56 | 03.96 | 59 | 55.54 |
| | 2.5 | 17 | 08 | 00.91 | 23 | 23 | 44.04 | 59 | 36.38 |
| | 3.0 | 17 | 38 | 49.30 | 24 | 28 | 03.67 | 59 | 15.77 |
| | 3.5 | 18 | 09 | 40.23 | 25 | 08 | 18.70 | 58 | 54.22 |
| | 4.0 | 18 | 40 | 21.81 | -25 | 24 | 22.98 | 58 | 32.19 |
| | 4.5 | 19 | 10 | 42.15 | 25 | 16 | 46.98 | 58 | 10.08 |
| | 5.0 | 19 | 40 | 30.42 | 24 | 46 | 33.79 | 57 | 48.24 |
| | 5.5 | 20 | 09 | 37.76 | 23 | 55 | 12.91 | 57 | 26.93 |
| | 6.0 | 20 | 37 | 57.79 | 22 | 44 | 33.00 | 57 | 06.37 |
| | 6.5 | 21 | 05 | 26.82 | 21 | 16 | 34.64 | 56 | 46.71 |
| | 7.0 | 21 | 32 | 03.70 | -19 | 33 | 23.78 | 56 | 28.06 |
| | 7.5 | 21 | 57 | 49.51 | 17 | 37 | 06.65 | 56 | 10.47 |
| | 8.0 | 22 | 22 | 47.14 | 15 | 29 | 46.10 | 55 | 53.98 |
| | 8.5 | 22 | 47 | 00.80 | 13 | 13 | 19.44 | 55 | 38.60 |
| | 9.0 | 23 | 10 | 35.64 | 10 | 49 | 37.34 | 55 | 24.31 |
| | 9.5 | 23 | 33 | 37.41 | 8 | 20 | 23.70 | 55 | 11.11 |
| | 10.0 | 23 | 56 | 12.18 | -5 | 47 | 15.97 | 54 | 58.97 |
| | 10.5 | 0 | 18 | 26.19 | -3 | 11 | 45.95 | 54 | 47.88 |
| | 11.0 | 0 | 40 | 25.67 | +0 | 35 | 20.69 | 54 | 37.84 |
| | 11.5 | 1 | 02 | 16.77 | 2 | 00 | 36.57 | 54 | 28.85 |
| | 12.0 | 1 | 24 | 05.47 | 4 | 34 | 45.46 | 54 | 20.95 |
| | 12.5 | 1 | 45 | 57.55 | 7 | 05 | 47.53 | 54 | 14.17 |
| | 13.0 | 2 | 07 | 58.51 | +9 | 32 | 25.54 | 54 | 08.58 |
| | 13.5 | 2 | 30 | 13.52 | 11 | 53 | 22.76 | 54 | 04.24 |
| | 14.0 | 2 | 52 | 47.31 | 14 | 07 | 22.49 | 54 | 01.26 |
| | 14.5 | 3 | 15 | 44.09 | 16 | 13 | 07.71 | 53 | 59.73 |
| | 15.0 | 3 | 39 | 07.42 | 18 | 09 | 21.03 | 53 | 59.76 |
| | 15.5 | 4 | 03 | 00.05 | 19 | 54 | 44.93 | 54 | 01.48 |
| | 16.0 | 4 | 27 | 23.77 | +21 | 28 | 02.31 | 54 | 05.00 |
| | 16.5 | 4 | 52 | 19.23 | 22 | 47 | 57.51 | 54 | 10.44 |
| | 17.0 | 5 | 17 | 45.86 | 23 | 53 | 17.72 | 54 | 17.91 |
| | 17.5 | 5 | 43 | 41.77 | 24 | 42 | 54.78 | 54 | 27.51 |
| | 18.0 | 6 | 10 | 03.77 | 25 | 15 | 47.31 | 54 | 39.31 |
| | 18.5 | 6 | 36 | 47.53 | 25 | 31 | 02.94 | 54 | 53.36 |
| | 19.0 | 7 | 03 | 47.82 | +25 | 28 | 00.53 | 55 | 09.70 |
| | 19.5 | 7 | 30 | 58.89 | 25 | 06 | 12.07 | 55 | 28.29 |
| | 20.0 | 7 | 58 | 14.90 | 24 | 25 | 24.11 | 55 | 49.08 |
| | 20.5 | 8 | 25 | 30.40 | 23 | 25 | 38.60 | 56 | 11.95 |
| | 21.0 | 8 | 52 | 40.76 | 22 | 07 | 13.24 | 56 | 36.71 |
| | 21.5 | 9 | 19 | 42.54 | 20 | 30 | 41.28 | 57 | 03.11 |
| | 22.0 | 9 | 46 | 33.73 | +18 | 36 | 51.22 | 57 | 30.82 |
| | 22.5 | 10 | 13 | 13.85 | 16 | 26 | 46.45 | 57 | 59.43 |
| | 23.0 | 10 | 39 | 43.99 | 14 | 01 | 45.08 | 58 | 28.43 |
| | 23.5 | 11 | 06 | 06.71 | 11 | 23 | 20.13 | 58 | 57.25 |
| | 24.0 | 11 | 32 | 25.86 | +8 | 33 | 20.00 | 59 | 25.25 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | Horizontal Parallax | |
|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | ' | " |
| Apr. | 24.0 | 11 | 32 | 25.86 | +8 | 33 | 20.00 | 59 | 25.25 |
| | 24.5 | 11 | 58 | 46.44 | 5 | 33 | 49.17 | 59 | 51.73 |
| | 25.0 | 12 | 25 | 14.32 | 2 | 27 | 08.90 | 60 | 15.97 |
| | 25.5 | 12 | 51 | 56.00 | +0 | 44 | 02.45 | 60 | 37.26 |
| | 26.0 | 13 | 18 | 58.24 | -3 | 56 | 49.59 | 60 | 54.94 |
| | 26.5 | 13 | 46 | 27.76 | 7 | 08 | 01.68 | 61 | 08.42 |
| | 27.0 | 14 | 14 | 30.72 | -10 | 14 | 14.85 | 61 | 17.28 |
| | 27.5 | 14 | 43 | 12.16 | 13 | 11 | 56.51 | 61 | 21.21 |
| | 28.0 | 15 | 12 | 35.39 | 15 | 57 | 31.41 | 61 | 20.12 |
| | 28.5 | 15 | 42 | 41.27 | 18 | 27 | 29.51 | 61 | 14.10 |
| | 29.0 | 16 | 13 | 27.55 | 20 | 38 | 35.47 | 61 | 03.42 |
| | 29.5 | 16 | 44 | 48.50 | 22 | 27 | 59.09 | 60 | 48.51 |
| | 30.0 | 17 | 16 | 34.77 | -23 | 53 | 25.56 | 60 | 29.91 |
| | 30.5 | 17 | 48 | 33.90 | 24 | 53 | 24.17 | 60 | 08.28 |
| May | 1.0 | 18 | 20 | 31.24 | 25 | 27 | 13.78 | 59 | 44.27 |
| | 1.5 | 18 | 52 | 11.45 | 25 | 35 | 03.77 | 59 | 18.59 |
| | 2.0 | 19 | 23 | 19.98 | 25 | 17 | 50.27 | 58 | 51.89 |
| | 2.5 | 19 | 53 | 44.45 | 24 | 37 | 08.18 | 58 | 24.78 |
| | 3.0 | 20 | 23 | 15.64 | -23 | 35 | 00.59 | 57 | 57.78 |
| | 3.5 | 20 | 51 | 47.84 | 22 | 13 | 47.63 | 57 | 31.37 |
| | 4.0 | 21 | 19 | 18.78 | 20 | 35 | 56.33 | 57 | 05.91 |
| | 4.5 | 21 | 45 | 49.16 | 18 | 43 | 52.56 | 56 | 41.71 |
| | 5.0 | 22 | 11 | 22.09 | 16 | 39 | 55.58 | 56 | 18.99 |
| | 5.5 | 22 | 36 | 02.38 | 14 | 26 | 14.85 | 55 | 57.90 |
| | 6.0 | 22 | 59 | 56.02 | -12 | 04 | 48.84 | 55 | 38.56 |
| | 6.5 | 23 | 23 | 09.70 | 9 | 37 | 25.18 | 55 | 21.00 |
| | 7.0 | 23 | 45 | 50.45 | 7 | 05 | 41.74 | 55 | 05.24 |
| | 7.5 | 0 | 08 | 05.41 | 4 | 31 | 08.19 | 54 | 51.26 |
| | 8.0 | 0 | 30 | 01.65 | -1 | 55 | 07.74 | 54 | 39.02 |
| | 8.5 | 0 | 51 | 46.09 | +0 | 41 | 01.03 | 54 | 28.47 |
| | 9.0 | 1 | 13 | 25.41 | +3 | 16 | 02.53 | 54 | 19.52 |
| | 9.5 | 1 | 35 | 05.98 | 5 | 48 | 42.65 | 54 | 12.13 |
| | 10.0 | 1 | 56 | 53.87 | 8 | 17 | 47.53 | 54 | 06.22 |
| | 10.5 | 2 | 18 | 54.71 | 10 | 42 | 02.48 | 54 | 01.73 |
| | 11.0 | 2 | 41 | 13.68 | 13 | 00 | 11.37 | 53 | 58.62 |
| | 11.5 | 3 | 03 | 55.37 | 15 | 10 | 56.22 | 53 | 56.86 |
| | | 3 | 27 | 03.66 | 17 | 12 | 57.20 | 53 | 56.43 |
| | 12.0 | | | | | | | | |
| | 12.5 | 3 | 50 | 41.57 | +19 | 04 | 53.10 | 53 | 57.33 |
| | 13.0 | 4 | 14 | 51.05 | 20 | 45 | 22.27 | 53 | 59.57 |
| | 13.5 | 4 | 39 | 32.85 | 22 | 13 | 04.02 | 54 | 03.20 |
| | 14.0 | 5 | 04 | 46.35 | 23 | 26 | 40.56 | 54 | 08.25 |
| | 14.5 | 5 | 30 | 29.50 | 24 | 24 | 59.31 | 54 | 14.79 |
| | 15.0 | 5 | 56 | 38.82 | +25 | 06 | 55.56 | 54 | 22.88 |
| | 15.5 | 6 | 23 | 09.56 | 25 | 31 | 35.07 | 54 | 32.60 |
| | 16.0 | 6 | 49 | 55.94 | 25 | 38 | 16.48 | 54 | 44.01 |
| | 16.5 | 7 | 16 | 51.63 | 25 | 26 | 33.13 | 54 | 57.18 |
| | 17.0 | 7 | 43 | 50.15 | +24 | 56 | 14.19 | 55 | 12.16 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | Horizontal Parallax | |
|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | ' | " |
| May | 17.0 | 7 | 43 | 50.15 | +24 | 56 | 14.19 | 55 | 12.16 |
| | 17.5 | 8 | 10 | 45.48 | 24 | 07 | 24.84 | 55 | 28.97 |
| | 18.0 | 8 | 37 | 32.44 | 23 | 00 | 25.63 | 55 | 47.63 |
| | 18.5 | 9 | 04 | 07.18 | 21 | 35 | 51.25 | 56 | 08.09 |
| | 19.0 | 9 | 30 | 27.32 | 19 | 54 | 28.95 | 56 | 30.27 |
| | 19.5 | 9 | 56 | 32.18 | 17 | 57 | 16.98 | 56 | 54.03 |
| | 20.0 | 10 | 22 | 22.71 | +15 | 45 | 23.43 | 57 | 19.17 |
| | 20.5 | 10 | 48 | 01.42 | 13 | 20 | 05.51 | 57 | 45.43 |
| | 21.0 | 11 | 13 | 32.22 | 10 | 42 | 49.67 | 58 | 12.45 |
| | 21.5 | 11 | 39 | 00.26 | 7 | 55 | 12.32 | 58 | 39.79 |
| | 22.0 | 12 | 04 | 31.73 | 4 | 59 | 01.20 | 59 | 06.95 |
| | 22.5 | 12 | 30 | 13.60 | +1 | 56 | 17.23 | 59 | 33.35 |
| | 23.0 | 12 | 56 | 13.45 | -1 | 10 | 43.57 | 59 | 58.34 |
| | 23.5 | 13 | 22 | 39.15 | 4 | 19 | 28.31 | 60 | 21.23 |
| | 24.0 | 13 | 49 | 38.52 | 7 | 27 | 06.11 | 60 | 41.34 |
| | 24.5 | 14 | 17 | 18.90 | 10 | 30 | 28.26 | 60 | 58.01 |
| | 25.0 | 14 | 45 | 46.53 | 13 | 26 | 10.12 | 61 | 10.65 |
| | 25.5 | 15 | 15 | 05.84 | 16 | 10 | 35.45 | 61 | 18.77 |
| | 26.0 | 15 | 45 | 18.57 | -18 | 40 | 03.66 | 61 | 22.04 |
| | 26.5 | 16 | 16 | 22.95 | 20 | 51 | 00.02 | 61 | 20.30 |
| | 27.0 | 16 | 48 | 13.00 | 22 | 40 | 08.60 | 61 | 13.57 |
| | 27.5 | 17 | 20 | 38.29 | 24 | 04 | 46.39 | 61 | 02.08 |
| | 28.0 | 17 | 53 | 24.31 | 25 | 02 | 56.87 | 60 | 46.19 |
| | 28.5 | 18 | 26 | 13.64 | 25 | 33 | 39.97 | 60 | 26.45 |
| | 29.0 | 18 | 58 | 47.66 | -25 | 36 | 56.39 | 60 | 03.48 |
| | 29.5 | 19 | 30 | 48.64 | 25 | 13 | 44.93 | 59 | 37.98 |
| | 30.0 | 20 | 02 | 01.51 | 24 | 25 | 53.33 | 59 | 10.66 |
| | 30.5 | 20 | 32 | 15.12 | 23 | 15 | 44.92 | 58 | 42.23 |
| | 31.0 | 21 | 01 | 22.72 | 21 | 46 | 03.90 | 58 | 13.35 |
| | 31.5 | 21 | 29 | 21.80 | 19 | 59 | 41.80 | 57 | 44.62 |
| June | 1.0 | 21 | 56 | 13.43 | -17 | 59 | 26.88 | 57 | 16.57 |
| | 1.5 | 22 | 22 | 01.46 | 15 | 47 | 56.97 | 56 | 49.64 |
| | 2.0 | 22 | 46 | 51.69 | 13 | 27 | 35.65 | 56 | 24.18 |
| | 2.5 | 23 | 10 | 51.13 | 11 | 00 | 30.90 | 56 | 00.48 |
| | 3.0 | 23 | 34 | 07.52 | 8 | 28 | 35.71 | 55 | 38.75 |
| | 3.5 | 23 | 56 | 48.83 | 5 | 53 | 29.72 | 55 | 19.13 |
| | 4.0 | 0 | 19 | 03.09 | -3 | 16 | 41.54 | 55 | 01.70 |
| | 4.5 | 0 | 40 | 58.13 | +0 | 39 | 31.17 | 54 | 46.50 |
| | 5.0 | 1 | 02 | 41.58 | 1 | 56 | 47.43 | 54 | 33.53 |
| | 5.5 | 1 | 24 | 20.73 | 4 | 31 | 04.05 | 54 | 22.74 |
| | 6.0 | 1 | 46 | 02.50 | 7 | 02 | 10.16 | 54 | 14.06 |
| | 6.5 | 2 | 07 | 53.41 | 9 | 28 | 57.09 | 54 | 07.43 |
| | 7.0 | 2 | 29 | 59.53 | +11 | 50 | 14.62 | 54 | 02.73 |
| | 7.5 | 2 | 52 | 26.32 | 14 | 04 | 49.93 | 53 | 59.86 |
| | 8.0 | 3 | 15 | 18.59 | 16 | 11 | 27.00 | 53 | 58.71 |
| | 8.5 | 3 | 38 | 40.27 | 18 | 08 | 46.61 | 53 | 59.16 |
| | 9.0 | 4 | 02 | 34.25 | +19 | 55 | 26.82 | 54 | 01.13 |

**MOON, 2021**
FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | Horizontal Parallax | |
|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | ' | " |
| June | 9.0 | 4 | 02 | 34.25 | +19 | 55 | 26.82 | 54 | 01.13 |
| | 9.5 | 4 | 27 | 02.17 | 21 | 30 | 04.29 | 54 | 04.50 |
| | 10.0 | 4 | 52 | 04.21 | 22 | 51 | 16.19 | 54 | 09.20 |
| | 10.5 | 5 | 17 | 38.95 | 23 | 57 | 42.86 | 54 | 15.15 |
| | 11.0 | 5 | 43 | 43.28 | 24 | 48 | 10.98 | 54 | 22.31 |
| | 11.5 | 6 | 10 | 12.51 | 25 | 21 | 37.04 | 54 | 30.62 |
| | 12.0 | 6 | 37 | 00.58 | +25 | 37 | 10.72 | 54 | 40.08 |
| | 12.5 | 7 | 04 | 00.45 | 25 | 34 | 17.82 | 54 | 50.66 |
| | 13.0 | 7 | 31 | 04.66 | 25 | 12 | 42.17 | 55 | 02.38 |
| | 13.5 | 7 | 58 | 05.89 | 24 | 32 | 26.51 | 55 | 15.25 |
| | 14.0 | 8 | 24 | 57.59 | 23 | 33 | 51.97 | 55 | 29.29 |
| | 14.5 | 8 | 51 | 34.46 | 22 | 17 | 36.52 | 55 | 44.50 |
| | 15.0 | 9 | 17 | 52.82 | +20 | 44 | 32.65 | 56 | 00.90 |
| | 15.5 | 9 | 43 | 50.77 | 18 | 55 | 44.64 | 56 | 18.48 |
| | 16.0 | 10 | 09 | 28.27 | 16 | 52 | 26.03 | 56 | 37.22 |
| | 16.5 | 10 | 34 | 47.01 | 14 | 35 | 57.50 | 56 | 57.05 |
| | 17.0 | 10 | 59 | 50.28 | 12 | 07 | 45.46 | 57 | 17.87 |
| | 17.5 | 11 | 24 | 42.76 | 9 | 29 | 21.53 | 57 | 39.53 |
| | 18.0 | 11 | 49 | 30.29 | +6 | 42 | 22.81 | 58 | 01.83 |
| | 18.5 | 12 | 14 | 19.67 | 3 | 48 | 32.97 | 58 | 24.50 |
| | 19.0 | 12 | 39 | 18.47 | +0 | 49 | 43.93 | 58 | 47.21 |
| | 19.5 | 13 | 04 | 34.79 | -2 | 12 | 02.01 | 59 | 09.56 |
| | 20.0 | 13 | 30 | 17.06 | 5 | 14 | 29.90 | 59 | 31.10 |
| | 20.5 | 13 | 56 | 33.71 | 8 | 15 | 10.10 | 59 | 51.31 |
| | 21.0 | 14 | 23 | 32.80 | -11 | 11 | 16.95 | 60 | 09.65 |
| | 21.5 | 14 | 51 | 21.42 | 13 | 59 | 48.71 | 60 | 25.56 |
| | 22.0 | 15 | 20 | 05.07 | 16 | 37 | 29.58 | 60 | 38.50 |
| | 22.5 | 15 | 49 | 46.72 | 19 | 00 | 54.37 | 60 | 47.97 |
| | 23.0 | 16 | 20 | 25.94 | 21 | 06 | 36.62 | 60 | 53.57 |
| | 23.5 | 16 | 51 | 58.08 | 22 | 51 | 20.01 | 60 | 54.98 |
| | 24.0 | 17 | 24 | 13.76 | -24 | 12 | 12.60 | 60 | 52.04 |
| | 24.5 | 17 | 56 | 59.03 | 25 | 07 | 01.82 | 60 | 44.73 |
| | 25.0 | 18 | 29 | 56.34 | 25 | 34 | 27.73 | 60 | 33.20 |
| | 25.5 | 19 | 02 | 46.19 | 25 | 34 | 11.23 | 60 | 17.74 |
| | 26.0 | 19 | 35 | 09.32 | 25 | 06 | 55.32 | 59 | 58.77 |
| | 26.5 | 20 | 06 | 48.78 | 24 | 14 | 18.65 | 59 | 36.82 |
| | 27.0 | 20 | 37 | 31.46 | -22 | 58 | 43.19 | 59 | 12.50 |
| | 27.5 | 21 | 07 | 08.86 | 21 | 22 | 58.90 | 58 | 46.43 |
| | 28.0 | 21 | 35 | 37.11 | 19 | 30 | 08.49 | 58 | 19.27 |
| | 28.5 | 22 | 02 | 56.33 | 17 | 23 | 14.60 | 57 | 51.63 |
| | 29.0 | 22 | 29 | 09.81 | 15 | 05 | 10.58 | 57 | 24.12 |
| | 29.5 | 22 | 54 | 23.14 | 12 | 38 | 34.95 | 56 | 57.23 |
| | 30.0 | 23 | 18 | 43.33 | -10 | 05 | 48.93 | 56 | 31.45 |
| | 30.5 | 23 | 42 | 18.27 | 7 | 28 | 56.39 | 56 | 07.15 |
| July | 1.0 | 0 | 05 | 16.19 | 4 | 49 | 45.18 | 55 | 44.66 |
| | 1.5 | 0 | 27 | 45.42 | -2 | 09 | 49.45 | 55 | 24.21 |
| | 2.0 | 0 | 49 | 54.14 | +0 | 29 | 27.63 | 55 | 06.00 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | Horizontal Parallax | |
|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | ' | " |
| July | 1.0 | 0 | 05 | 16.19 | -4 | 49 | 45.18 | 55 | 44.66 |
| | 1.5 | 0 | 27 | 45.42 | -2 | 09 | 49.45 | 55 | 24.21 |
| | 2.0 | 0 | 49 | 54.14 | +0 | 29 | 27.63 | 55 | 06.00 |
| | 2.5 | 1 | 11 | 50.32 | 3 | 06 | 51.13 | 54 | 50.15 |
| | 3.0 | 1 | 33 | 41.59 | 5 | 41 | 11.60 | 54 | 36.73 |
| | 3.5 | 1 | 55 | 35.21 | 8 | 11 | 22.62 | 54 | 25.77 |
| | 4.0 | 2 | 17 | 38.04 | +10 | 36 | 18.60 | 54 | 17.26 |
| | 4.5 | 2 | 39 | 56.43 | 12 | 54 | 52.93 | 54 | 11.16 |
| | 5.0 | 3 | 02 | 36.14 | 15 | 05 | 56.54 | 54 | 07.37 |
| | 5.5 | 3 | 25 | 42.21 | 17 | 08 | 17.03 | 54 | 05.81 |
| | 6.0 | 3 | 49 | 18.74 | 19 | 00 | 38.25 | 54 | 06.36 |
| | 6.5 | 4 | 13 | 28.74 | 20 | 41 | 40.71 | 54 | 08.86 |
| | 7.0 | 4 | 38 | 13.83 | +22 | 10 | 02.76 | 54 | 13.18 |
| | 7.5 | 5 | 03 | 34.06 | 23 | 24 | 22.57 | 54 | 19.16 |
| | 8.0 | 5 | 29 | 27.71 | 24 | 23 | 21.04 | 54 | 26.63 |
| | 8.5 | 5 | 55 | 51.29 | 25 | 05 | 45.36 | 54 | 35.43 |
| | 9.0 | 6 | 22 | 39.53 | 25 | 30 | 32.98 | 54 | 45.41 |
| | 9.5 | 6 | 49 | 45.74 | 25 | 36 | 55.65 | 54 | 56.41 |
| | 10.0 | 7 | 17 | 02.23 | +25 | 24 | 22.77 | 55 | 08.29 |
| | 10.5 | 7 | 44 | 20.91 | 24 | 52 | 43.88 | 55 | 20.93 |
| | 11.0 | 8 | 11 | 33.96 | 24 | 02 | 09.65 | 55 | 34.21 |
| | 11.5 | 8 | 38 | 34.47 | 22 | 53 | 11.42 | 55 | 48.05 |
| | 12.0 | 9 | 05 | 16.95 | 21 | 26 | 39.44 | 56 | 02.36 |
| | 12.5 | 9 | 31 | 37.68 | 19 | 43 | 40.07 | 56 | 17.08 |
| | | 9 | 57 | 34.86 | 17 | 45 | 32.59 | 56 | 32.17 |
| | 13.0 | | | | | | | | |
| | 13.5 | 10 | 23 | 08.64 | +15 | 33 | 46.04 | 56 | 47.58 |
| | 14.0 | 10 | 48 | 20.96 | 13 | 09 | 56.37 | 57 | 03.28 |
| | 14.5 | 11 | 13 | 15.32 | 10 | 35 | 44.45 | 57 | 19.23 |
| | 15.0 | 11 | 37 | 56.62 | 7 | 52 | 54.80 | 57 | 35.38 |
| | 15.5 | 12 | 02 | 30.85 | 5 | 03 | 15.17 | 57 | 51.66 |
| | 16.0 | 12 | 27 | 04.88 | +2 | 08 | 36.94 | 58 | 07.99 |
| | 16.5 | 12 | 51 | 46.28 | +0 | 49 | 03.86 | 58 | 24.24 |
| | 17.0 | 13 | 16 | 43.08 | -3 | 47 | 45.05 | 58 | 40.24 |
| | 17.5 | 13 | 42 | 03.56 | 6 | 45 | 16.49 | 58 | 55.82 |
| | 18.0 | 14 | 07 | 55.96 | 9 | 39 | 18.37 | 59 | 10.71 |
| | 18.5 | 14 | 34 | 28.10 | 12 | 27 | 19.89 | 59 | 24.64 |
| | 19.0 | 15 | 01 | 46.92 | -15 | 06 | 38.79 | 59 | 37.28 |
| | 19.5 | 15 | 29 | 57.84 | 17 | 34 | 22.45 | 59 | 48.30 |
| | 20.0 | 15 | 59 | 03.99 | 19 | 47 | 31.11 | 59 | 57.34 |
| | 20.5 | 16 | 29 | 05.41 | 21 | 43 | 03.80 | 60 | 04.05 |
| | 21.0 | 16 | 59 | 58.31 | 23 | 18 | 07.29 | 60 | 08.11 |
| | 21.5 | 17 | 31 | 34.62 | 24 | 30 | 07.56 | 60 | 09.24 |
| | 22.0 | 18 | 03 | 42.02 | -25 | 17 | 02.71 | 60 | 07.24 |
| | 22.5 | 18 | 36 | 04.75 | 25 | 37 | 34.97 | 60 | 01.98 |
| | 23.0 | 19 | 08 | 24.97 | 25 | 31 | 19.37 | 59 | 53.44 |
| | 23.5 | 19 | 40 | 24.70 | 24 | 58 | 46.91 | 59 | 41.72 |
| | 24.0 | 20 | 11 | 47.65 | -24 | 01 | 21.16 | 59 | 27.01 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | Horizontal Parallax | |
|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | ' | " |
| July | 24.0 | 20 | 11 | 47.65 | -24 | 01 | 21.16 | 59 | 27.01 |
| | 24.5 | 20 | 42 | 20.80 | 22 | 41 | 09.30 | 59 | 09.60 |
| | 25.0 | 21 | 11 | 55.19 | 21 | 00 | 49.44 | 58 | 49.86 |
| | 25.5 | 21 | 40 | 26.12 | 19 | 03 | 17.08 | 58 | 28.25 |
| | 26.0 | 22 | 07 | 52.73 | 16 | 51 | 32.77 | 58 | 05.24 |
| | 26.5 | 22 | 34 | 17.32 | 14 | 28 | 32.38 | 57 | 41.35 |
| | 27.0 | 22 | 59 | 44.55 | -11 | 57 | 00.57 | 57 | 17.09 |
| | 27.5 | 23 | 24 | 20.64 | 9 | 19 | 27.00 | 56 | 52.94 |
| | 28.0 | 23 | 48 | 12.84 | 6 | 38 | 05.07 | 56 | 29.39 |
| | 28.5 | 0 | 11 | 28.86 | 3 | 54 | 52.26 | 56 | 06.84 |
| | 29.0 | 0 | 34 | 16.65 | -1 | 11 | 31.60 | 55 | 45.67 |
| | 29.5 | 0 | 56 | 44.08 | +1 | 30 | 26.11 | 55 | 26.20 |
| | 30.0 | 1 | 18 | 58.90 | +4 | 09 | 39.87 | 55 | 08.70 |
| | 30.5 | 1 | 41 | 08.56 | 6 | 44 | 55.92 | 54 | 53.39 |
| | 31.0 | 2 | 03 | 20.21 | 9 | 15 | 05.25 | 54 | 40.43 |
| | 31.5 | 2 | 25 | 40.58 | 11 | 39 | 01.35 | 54 | 29.93 |
| Aug. | 1.0 | 2 | 48 | 15.96 | 13 | 55 | 38.20 | 54 | 21.97 |
| | 1.5 | 3 | 11 | 12.04 | 16 | 03 | 48.66 | 54 | 16.58 |
| | 2.0 | 3 | 34 | 33.78 | +18 | 02 | 23.31 | 54 | 13.73 |
| | 2.5 | 3 | 58 | 25.26 | 19 | 50 | 09.83 | 54 | 13.40 |
| | 3.0 | 4 | 22 | 49.41 | 21 | 25 | 53.11 | 54 | 15.49 |
| | 3.5 | 4 | 47 | 47.85 | 22 | 48 | 16.09 | 54 | 19.91 |
| | 4.0 | 5 | 13 | 20.60 | 23 | 56 | 01.52 | 54 | 26.50 |
| | 4.5 | 5 | 39 | 26.00 | 24 | 47 | 54.54 | 54 | 35.10 |
| | 5.0 | 6 | 06 | 00.59 | +25 | 22 | 46.07 | 54 | 45.51 |
| | 5.5 | 6 | 32 | 59.21 | 25 | 39 | 36.70 | 54 | 57.54 |
| | 6.0 | 7 | 00 | 15.33 | 25 | 37 | 40.60 | 55 | 10.94 |
| | 6.5 | 7 | 27 | 41.42 | 25 | 16 | 29.21 | 55 | 25.47 |
| | 7.0 | 7 | 55 | 09.62 | 24 | 35 | 53.86 | 55 | 40.88 |
| | 7.5 | 8 | 22 | 32.33 | 23 | 36 | 07.33 | 55 | 56.92 |
| | 8.0 | 8 | 49 | 42.83 | +22 | 17 | 43.86 | 56 | 13.33 |
| | 8.5 | 9 | 16 | 35.83 | 20 | 41 | 37.94 | 56 | 29.87 |
| | 9.0 | 9 | 43 | 07.75 | 18 | 49 | 02.00 | 56 | 46.31 |
| | 9.5 | 10 | 09 | 16.91 | 16 | 41 | 23.53 | 57 | 02.46 |
| | 10.0 | 10 | 35 | 03.51 | 14 | 20 | 22.06 | 57 | 18.12 |
| | 10.5 | 11 | 00 | 29.46 | 11 | 47 | 46.23 | 57 | 33.16 |
| | 11.0 | 11 | 25 | 38.25 | +9 | 05 | 31.47 | 57 | 47.45 |
| | 11.5 | 11 | 50 | 34.63 | 6 | 15 | 38.11 | 58 | 00.90 |
| | 12.0 | 12 | 15 | 24.40 | 3 | 20 | 10.34 | 58 | 13.46 |
| | 12.5 | 12 | 40 | 14.16 | +0 | 21 | 15.62 | 58 | 25.08 |
| | 13.0 | 13 | 05 | 11.11 | -2 | 38 | 55.21 | 58 | 35.75 |
| | 13.5 | 13 | 30 | 22.77 | 5 | 38 | 07.55 | 58 | 45.45 |
| | 14.0 | 13 | 55 | 56.76 | -8 | 34 | 02.31 | 58 | 54.16 |
| | 14.5 | 14 | 22 | 00.47 | 11 | 24 | 15.22 | 59 | 01.88 |
| | 15.0 | 14 | 48 | 40.73 | 14 | 06 | 16.53 | 59 | 08.58 |
| | 15.5 | 15 | 16 | 03.28 | 16 | 37 | 31.35 | 59 | 14.19 |
| | 16.0 | 15 | 44 | 12.23 | -18 | 55 | 21.25 | 59 | 18.66 |

**MOON, 2021**
FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | Horizontal Parallax | |
|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | ' | " |
| Aug. | 16.0 | 15 | 44 | 12.23 | -18 | 55 | 21.25 | 59 | 18.66 |
| | 16.5 | 16 | 13 | 09.41 | 20 | 57 | 07.45 | 59 | 21.90 |
| | 17.0 | 16 | 42 | 53.73 | 22 | 40 | 16.07 | 59 | 23.79 |
| | 17.5 | 17 | 13 | 20.71 | 24 | 02 | 25.41 | 59 | 24.21 |
| | 18.0 | 17 | 44 | 22.24 | 25 | 01 | 34.83 | 59 | 23.03 |
| | 18.5 | 18 | 15 | 46.85 | 25 | 36 | 14.14 | 59 | 20.12 |
| | 19.0 | 18 | 47 | 20.50 | -25 | 45 | 32.00 | 59 | 15.37 |
| | 19.5 | 19 | 18 | 47.88 | 25 | 29 | 21.44 | 59 | 08.71 |
| | 20.0 | 19 | 49 | 53.87 | 24 | 48 | 21.30 | 59 | 00.07 |
| | 20.5 | 20 | 20 | 25.07 | 23 | 43 | 53.05 | 58 | 49.46 |
| | 21.0 | 20 | 50 | 10.86 | 22 | 17 | 53.72 | 58 | 36.94 |
| | 21.5 | 21 | 19 | 04.08 | 20 | 32 | 46.40 | 58 | 22.62 |
| | 22.0 | 21 | 47 | 01.03 | -18 | 31 | 09.95 | 58 | 06.67 |
| | 22.5 | 22 | 14 | 01.23 | 16 | 15 | 49.64 | 57 | 49.32 |
| | 23.0 | 22 | 40 | 06.83 | 13 | 49 | 29.34 | 57 | 30.84 |
| | 23.5 | 23 | 05 | 21.98 | 11 | 14 | 45.93 | 57 | 11.54 |
| | 24.0 | 23 | 29 | 52.20 | 8 | 34 | 05.75 | 56 | 51.77 |
| | 24.5 | 23 | 53 | 43.95 | 5 | 49 | 42.79 | 56 | 31.88 |
| | 25.0 | 0 | 17 | 04.16 | -3 | 03 | 38.24 | 56 | 12.24 |
| | 25.5 | 0 | 39 | 60.00 | +0 | 17 | 41.03 | 55 | 53.19 |
| | 26.0 | 1 | 02 | 38.62 | 2 | 26 | 30.88 | 55 | 35.09 |
| | 26.5 | 1 | 25 | 07.09 | 5 | 07 | 28.94 | 55 | 18.26 |
| | 27.0 | 1 | 47 | 32.23 | 7 | 43 | 52.16 | 55 | 02.97 |
| | 27.5 | 2 | 10 | 00.57 | 10 | 14 | 25.14 | 54 | 49.49 |
| | 28.0 | 2 | 32 | 38.27 | +12 | 37 | 56.34 | 54 | 38.04 |
| | 28.5 | 2 | 55 | 31.03 | 14 | 53 | 16.29 | 54 | 28.82 |
| | 29.0 | 3 | 18 | 43.95 | 16 | 59 | 16.26 | 54 | 21.96 |
| | 29.5 | 3 | 42 | 21.43 | 18 | 54 | 47.16 | 54 | 17.59 |
| | 30.0 | 4 | 06 | 26.98 | 20 | 38 | 38.97 | 54 | 15.78 |
| | 30.5 | 4 | 31 | 03.04 | 22 | 09 | 40.72 | 54 | 16.56 |
| | 31.0 | 4 | 56 | 10.77 | +23 | 26 | 41.17 | 54 | 19.94 |
| | 31.5 | 5 | 21 | 49.91 | 24 | 28 | 30.14 | 54 | 25.88 |
| Sept. | 1.0 | 5 | 47 | 58.63 | 25 | 14 | 00.65 | 54 | 34.29 |
| | 1.5 | 6 | 14 | 33.58 | 25 | 42 | 11.62 | 54 | 45.07 |
| | 2.0 | 6 | 41 | 29.94 | 25 | 52 | 10.99 | 54 | 58.05 |
| | 2.5 | 7 | 08 | 41.76 | 25 | 43 | 18.98 | 55 | 13.05 |
| | 3.0 | 7 | 36 | 02.37 | +25 | 15 | 11.04 | 55 | 29.81 |
| | 3.5 | 8 | 03 | 24.87 | 24 | 27 | 40.26 | 55 | 48.07 |
| | 4.0 | 8 | 30 | 42.72 | 23 | 20 | 58.80 | 56 | 07.50 |
| | 4.5 | 8 | 57 | 50.24 | 21 | 55 | 38.44 | 56 | 27.77 |
| | 5.0 | 9 | 24 | 43.06 | 20 | 12 | 30.12 | 56 | 48.51 |
| | 5.5 | 9 | 51 | 18.37 | 18 | 12 | 42.73 | 57 | 09.32 |
| | 6.0 | 10 | 17 | 35.07 | +15 | 57 | 41.43 | 57 | 29.81 |
| | 6.5 | 10 | 43 | 33.74 | 13 | 29 | 05.75 | 57 | 49.59 |
| | 7.0 | 11 | 09 | 16.52 | 10 | 48 | 47.63 | 58 | 08.28 |
| | 7.5 | 11 | 34 | 46.96 | 7 | 58 | 49.67 | 58 | 25.56 |
| | 8.0 | 12 | 00 | 09.76 | +5 | 01 | 23.53 | 58 | 41.12 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | Horizontal Parallax | |
|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | ' | " |
| Sept. | 8.0 | 12 | 00 | 09.76 | +5 | 01 | 23.53 | 58 | 41.12 |
| | 8.5 | 12 | 25 | 30.55 | +1 | 58 | 48.60 | 58 | 54.74 |
| | 9.0 | 12 | 50 | 55.63 | -1 | 06 | 29.12 | 59 | 06.23 |
| | 9.5 | 13 | 16 | 31.75 | 4 | 11 | 58.03 | 59 | 15.50 |
| | 10.0 | 13 | 42 | 25.81 | 7 | 15 | 01.74 | 59 | 22.52 |
| | 10.5 | 14 | 08 | 44.56 | 10 | 13 | 00.06 | 59 | 27.32 |
| | 11.0 | 14 | 35 | 34.26 | -13 | 03 | 10.09 | 59 | 29.98 |
| | 11.5 | 15 | 03 | 00.18 | 15 | 42 | 47.79 | 59 | 30.64 |
| | 12.0 | 15 | 31 | 06.16 | 18 | 09 | 10.29 | 59 | 29.44 |
| | 12.5 | 15 | 59 | 54.00 | 20 | 19 | 39.16 | 59 | 26.58 |
| | 13.0 | 16 | 29 | 22.98 | 22 | 11 | 45.06 | 59 | 22.22 |
| | 13.5 | 16 | 59 | 29.37 | 23 | 43 | 13.51 | 59 | 16.54 |
| | 14.0 | 17 | 30 | 06.32 | -24 | 52 | 11.68 | 59 | 09.69 |
| | 14.5 | 18 | 01 | 04.01 | 25 | 37 | 15.33 | 59 | 01.81 |
| | 15.0 | 18 | 32 | 10.32 | 25 | 57 | 34.89 | 58 | 53.00 |
| | 15.5 | 19 | 03 | 11.83 | 25 | 52 | 59.37 | 58 | 43.34 |
| | 16.0 | 19 | 33 | 55.10 | 25 | 23 | 57.28 | 58 | 32.89 |
| | 16.5 | 20 | 04 | 07.93 | 24 | 31 | 34.12 | 58 | 21.69 |
| | 17.0 | 20 | 33 | 40.36 | -23 | 17 | 26.96 | 58 | 09.76 |
| | 17.5 | 21 | 02 | 25.31 | 21 | 43 | 37.16 | 57 | 57.13 |
| | 18.0 | 21 | 30 | 18.76 | 19 | 52 | 22.28 | 57 | 43.83 |
| | 18.5 | 21 | 57 | 19.58 | 17 | 46 | 08.64 | 57 | 29.89 |
| | 19.0 | 22 | 23 | 29.10 | 15 | 27 | 24.86 | 57 | 15.38 |
| | 19.5 | 22 | 48 | 50.63 | 12 | 58 | 37.13 | 57 | 00.36 |
| | 20.0 | 23 | 13 | 28.86 | -10 | 22 | 05.88 | 56 | 44.94 |
| | 20.5 | 23 | 37 | 29.49 | 7 | 40 | 03.79 | 56 | 29.26 |
| | 21.0 | 0 | 00 | 58.78 | 4 | 54 | 34.87 | 56 | 13.46 |
| | 21.5 | 0 | 24 | 03.29 | -2 | 07 | 34.32 | 55 | 57.73 |
| | 22.0 | 0 | 46 | 49.66 | +0 | 39 | 11.12 | 55 | 42.26 |
| | 22.5 | 1 | 09 | 24.47 | 3 | 24 | 02.46 | 55 | 27.29 |
| | 23.0 | 1 | 31 | 54.12 | +6 | 05 | 27.46 | 55 | 13.02 |
| | 23.5 | 1 | 54 | 24.74 | 8 | 41 | 59.63 | 54 | 59.71 |
| | 24.0 | 2 | 17 | 02.12 | 11 | 12 | 17.10 | 54 | 47.57 |
| | 24.5 | 2 | 39 | 51.61 | 13 | 35 | 01.60 | 54 | 36.85 |
| | 25.0 | 3 | 02 | 58.03 | 15 | 48 | 57.49 | 54 | 27.75 |
| | 25.5 | 3 | 26 | 25.57 | 17 | 52 | 51.05 | 54 | 20.48 |
| | 26.0 | 3 | 50 | 17.61 | +19 | 45 | 30.01 | 54 | 15.23 |
| | 26.5 | 4 | 14 | 36.60 | 21 | 25 | 43.45 | 54 | 12.17 |
| | 27.0 | 4 | 39 | 23.91 | 22 | 52 | 22.14 | 54 | 11.42 |
| | 27.5 | 5 | 04 | 39.66 | 24 | 04 | 19.31 | 54 | 13.11 |
| | 28.0 | 5 | 30 | 22.67 | 25 | 00 | 32.00 | 54 | 17.32 |
| | 28.5 | 5 | 56 | 30.42 | 25 | 40 | 02.78 | 54 | 24.09 |
| | 29.0 | 6 | 22 | 59.13 | +26 | 02 | 01.74 | 54 | 33.44 |
| | 29.5 | 6 | 49 | 44.00 | 26 | 05 | 48.71 | 54 | 45.35 |
| | 30.0 | 7 | 16 | 39.49 | 25 | 50 | 55.26 | 54 | 59.73 |
| | 30.5 | 7 | 43 | 39.76 | 25 | 17 | 06.44 | 55 | 16.48 |
| Oct. | 1.0 | 8 | 10 | 39.13 | +24 | 24 | 22.02 | 55 | 35.42 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | Horizontal Parallax | |
|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | ' | " |
| Oct. | 1.0 | 8 | 10 | 39.13 | +24 | 24 | 22.02 | 55 | 35.42 |
| | 1.5 | 8 | 37 | 32.51 | 23 | 12 | 57.07 | 55 | 56.32 |
| | 2.0 | 9 | 04 | 15.81 | 21 | 43 | 22.18 | 56 | 18.90 |
| | 2.5 | 9 | 30 | 46.25 | 19 | 56 | 23.12 | 56 | 42.82 |
| | 3.0 | 9 | 57 | 02.49 | 17 | 53 | 00.36 | 57 | 07.68 |
| | 3.5 | 10 | 23 | 04.70 | 15 | 34 | 28.58 | 57 | 33.00 |
| | 4.0 | 10 | 48 | 54.54 | +13 | 02 | 16.23 | 57 | 58.30 |
| | 4.5 | 11 | 14 | 35.03 | 10 | 18 | 05.27 | 58 | 23.02 |
| | 5.0 | 11 | 40 | 10.36 | 7 | 23 | 51.08 | 58 | 46.62 |
| | 5.5 | 12 | 05 | 45.73 | 4 | 21 | 42.42 | 59 | 08.53 |
| | 6.0 | 12 | 31 | 27.13 | +1 | 14 | 01.24 | 59 | 28.24 |
| | 6.5 | 12 | 57 | 21.06 | -1 | 56 | 37.67 | 59 | 45.25 |
| | 7.0 | 13 | 23 | 34.33 | -5 | 07 | 27.54 | 59 | 59.19 |
| | 7.5 | 13 | 50 | 13.68 | 8 | 15 | 31.04 | 60 | 09.76 |
| | 8.0 | 14 | 17 | 25.40 | 11 | 17 | 42.42 | 60 | 16.77 |
| | 8.5 | 14 | 45 | 14.89 | 14 | 10 | 50.69 | 60 | 20.17 |
| | 9.0 | 15 | 13 | 46.06 | 16 | 51 | 43.74 | 60 | 20.03 |
| | 9.5 | 15 | 43 | 00.73 | 19 | 17 | 13.83 | 60 | 16.52 |
| | 10.0 | 16 | 12 | 58.01 | -21 | 24 | 24.23 | 60 | 09.93 |
| | 10.5 | 16 | 43 | 33.85 | 23 | 10 | 36.97 | 60 | 00.58 |
| | 11.0 | 17 | 14 | 40.80 | 24 | 33 | 41.05 | 59 | 48.89 |
| | 11.5 | 17 | 46 | 08.24 | 25 | 32 | 00.29 | 59 | 35.26 |
| | 12.0 | 18 | 17 | 43.07 | 26 | 04 | 39.44 | 59 | 20.11 |
| | 12.5 | 18 | 49 | 10.91 | 26 | 11 | 27.33 | 59 | 03.83 |
| | 13.0 | 19 | 20 | 17.43 | -25 | 52 | 56.33 | 58 | 46.80 |
| | 13.5 | 19 | 50 | 49.79 | 25 | 10 | 17.88 | 58 | 29.32 |
| | 14.0 | 20 | 20 | 37.67 | 24 | 05 | 15.17 | 58 | 11.65 |
| | 14.5 | 20 | 49 | 33.95 | 22 | 39 | 54.14 | 57 | 54.03 |
| | 15.0 | 21 | 17 | 34.78 | 20 | 56 | 34.36 | 57 | 36.61 |
| | 15.5 | 21 | 44 | 39.41 | 18 | 57 | 41.16 | 57 | 19.51 |
| | 16.0 | 22 | 10 | 49.63 | -16 | 45 | 39.39 | 57 | 02.82 |
| | 16.5 | 22 | 36 | 09.21 | 14 | 22 | 49.30 | 56 | 46.60 |
| | 17.0 | 23 | 00 | 43.34 | 11 | 51 | 24.04 | 56 | 30.88 |
| | 17.5 | 23 | 24 | 38.11 | 9 | 13 | 28.68 | 56 | 15.68 |
| | 18.0 | 23 | 48 | 00.16 | 6 | 31 | 00.18 | 56 | 01.02 |
| | 18.5 | 0 | 10 | 56.34 | -3 | 45 | 47.91 | 55 | 46.91 |
| | 19.0 | 0 | 33 | 33.52 | +0 | 59 | 34.62 | 55 | 33.37 |
| | 19.5 | 0 | 55 | 58.46 | 1 | 46 | 02.55 | 55 | 20.44 |
| | 20.0 | 1 | 18 | 17.70 | 4 | 29 | 31.01 | 55 | 08.16 |
| | 20.5 | 1 | 40 | 37.43 | 7 | 09 | 21.75 | 54 | 56.61 |
| | 21.0 | 2 | 03 | 03.50 | 9 | 44 | 08.57 | 54 | 45.88 |
| | 21.5 | 2 | 25 | 41.25 | 12 | 12 | 27.35 | 54 | 36.05 |
| | 22.0 | 2 | 48 | 35.49 | +14 | 32 | 55.69 | 54 | 27.25 |
| | 22.5 | 3 | 11 | 50.31 | 16 | 44 | 12.66 | 54 | 19.61 |
| | 23.0 | 3 | 35 | 29.03 | 18 | 44 | 58.93 | 54 | 13.28 |
| | 23.5 | 3 | 59 | 33.98 | 20 | 33 | 57.17 | 54 | 08.41 |
| | 24.0 | 4 | 24 | 06.39 | +22 | 09 | 52.81 | 54 | 05.15 |

**MOON, 2021**

FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | Horizontal Parallax | |
|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | ' | " |
| Oct. | 24.0 | 4 | 24 | 06.39 | +22 | 09 | 52.81 | 54 | 05.15 |
| | 24.5 | 4 | 49 | 06.25 | 23 | 31 | 35.22 | 54 | 03.65 |
| | 25.0 | 5 | 14 | 32.27 | 24 | 37 | 59.17 | 54 | 04.07 |
| | 25.5 | 5 | 40 | 21.82 | 25 | 28 | 06.53 | 54 | 06.54 |
| | 26.0 | 6 | 06 | 31.09 | 26 | 01 | 08.09 | 54 | 11.20 |
| | 26.5 | 6 | 32 | 55.24 | 26 | 16 | 25.32 | 54 | 18.15 |
| | 27.0 | 6 | 59 | 28.80 | +26 | 13 | 31.73 | 54 | 27.48 |
| | 27.5 | 7 | 26 | 06.02 | 25 | 52 | 13.85 | 54 | 39.25 |
| | 28.0 | 7 | 52 | 41.34 | 25 | 12 | 31.58 | 54 | 53.48 |
| | 28.5 | 8 | 19 | 09.84 | 24 | 14 | 37.90 | 55 | 10.16 |
| | 29.0 | 8 | 45 | 27.59 | 22 | 58 | 58.22 | 55 | 29.21 |
| | 29.5 | 9 | 11 | 31.93 | 21 | 26 | 09.37 | 55 | 50.53 |
| | 30.0 | 9 | 37 | 21.65 | +19 | 36 | 58.64 | 56 | 13.94 |
| | 30.5 | 10 | 02 | 57.02 | 17 | 32 | 23.00 | 56 | 39.17 |
| | 31.0 | 10 | 28 | 19.80 | 15 | 13 | 28.81 | 57 | 05.93 |
| | 31.5 | 10 | 53 | 33.07 | 12 | 41 | 32.02 | 57 | 33.79 |
| Nov. | 1.0 | 11 | 18 | 41.17 | 9 | 57 | 58.98 | 58 | 02.28 |
| | 1.5 | 11 | 43 | 49.48 | 7 | 04 | 27.78 | 58 | 30.86 |
| | 2.0 | 12 | 09 | 04.28 | +4 | 02 | 49.87 | 58 | 58.89 |
| | 2.5 | 12 | 34 | 32.54 | +0 | 55 | 11.89 | 59 | 25.70 |
| | 3.0 | 13 | 00 | 21.74 | -2 | 16 | 02.63 | 59 | 50.61 |
| | 3.5 | 13 | 26 | 39.57 | 5 | 28 | 12.21 | 60 | 12.92 |
| | 4.0 | 13 | 53 | 33.57 | 8 | 38 | 17.15 | 60 | 31.99 |
| | 4.5 | 14 | 21 | 10.72 | 11 | 43 | 00.76 | 60 | 47.24 |
| | 5.0 | 14 | 49 | 36.79 | -14 | 38 | 52.44 | 60 | 58.22 |
| | 5.5 | 15 | 18 | 55.61 | 17 | 22 | 13.04 | 61 | 04.63 |
| | 6.0 | 15 | 49 | 08.26 | 19 | 49 | 22.84 | 61 | 06.33 |
| | 6.5 | 16 | 20 | 12.23 | 21 | 56 | 52.07 | 61 | 03.35 |
| | 7.0 | 16 | 52 | 00.81 | 23 | 41 | 33.46 | 60 | 55.92 |
| | 7.5 | 17 | 24 | 23.00 | 25 | 00 | 55.46 | 60 | 44.39 |
| | 8.0 | 17 | 57 | 03.96 | -25 | 53 | 14.14 | 60 | 29.24 |
| | 8.5 | 18 | 29 | 46.27 | 26 | 17 | 41.43 | 60 | 11.04 |
| | 9.0 | 19 | 02 | 11.71 | 26 | 14 | 27.73 | 59 | 50.41 |
| | 9.5 | 19 | 34 | 03.24 | 25 | 44 | 38.13 | 59 | 27.97 |
| | 10.0 | 20 | 05 | 06.66 | 24 | 50 | 02.97 | 59 | 04.32 |
| | 10.5 | 20 | 35 | 11.74 | 23 | 33 | 05.03 | 58 | 40.02 |
| | 11.0 | 21 | 04 | 12.54 | -21 | 56 | 25.90 | 58 | 15.58 |
| | 11.5 | 21 | 32 | 07.20 | 20 | 02 | 53.74 | 57 | 51.42 |
| | 12.0 | 21 | 58 | 57.26 | 17 | 55 | 13.92 | 57 | 27.88 |
| | 12.5 | 22 | 24 | 46.84 | 15 | 36 | 02.85 | 57 | 05.26 |
| | 13.0 | 22 | 49 | 41.89 | 13 | 07 | 44.70 | 56 | 43.75 |
| | 13.5 | 23 | 13 | 49.46 | 10 | 32 | 30.41 | 56 | 23.51 |
| | 14.0 | 23 | 37 | 17.21 | -7 | 52 | 18.26 | 56 | 04.62 |
| | 14.5 | 0 | 00 | 13.02 | 5 | 08 | 55.38 | 55 | 47.14 |
| | 15.0 | 0 | 22 | 44.74 | -2 | 23 | 59.69 | 55 | 31.07 |
| | 15.5 | 0 | 45 | 00.04 | +0 | 20 | 57.95 | 55 | 16.40 |
| | 16.0 | 1 | 07 | 06.27 | +3 | 04 | 31.75 | 55 | 03.10 |

**MOON, 2021**
FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | Horizontal Parallax | |
|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | ' | " |
| Nov. | 16.0 | 1 | 07 | 06.27 | +3 | 04 | 31.75 | 55 | 03.10 |
| | 16.5 | 1 | 29 | 10.41 | 5 | 45 | 19.19 | 54 | 51.13 |
| | 17.0 | 1 | 51 | 19.00 | 8 | 21 | 59.45 | 54 | 40.43 |
| | 17.5 | 2 | 13 | 38.07 | 10 | 53 | 12.25 | 54 | 30.98 |
| | 18.0 | 2 | 36 | 13.04 | 13 | 17 | 37.06 | 54 | 22.72 |
| | 18.5 | 2 | 59 | 08.63 | 15 | 33 | 52.67 | 54 | 15.64 |
| | 19.0 | 3 | 22 | 28.72 | +17 | 40 | 37.33 | 54 | 09.74 |
| | 19.5 | 3 | 46 | 16.13 | 19 | 36 | 29.27 | 54 | 05.01 |
| | 20.0 | 4 | 10 | 32.55 | 21 | 20 | 07.83 | 54 | 01.50 |
| | 20.5 | 4 | 35 | 18.29 | 22 | 50 | 15.06 | 53 | 59.23 |
| | 21.0 | 5 | 00 | 32.20 | 24 | 05 | 37.81 | 53 | 58.29 |
| | 21.5 | 5 | 26 | 11.64 | 25 | 05 | 10.14 | 53 | 58.74 |
| | 22.0 | 5 | 52 | 12.53 | +25 | 47 | 55.88 | 54 | 00.68 |
| | 22.5 | 6 | 18 | 29.58 | 26 | 13 | 10.97 | 54 | 04.21 |
| | 23.0 | 6 | 44 | 56.62 | 26 | 20 | 25.46 | 54 | 09.44 |
| | 23.5 | 7 | 11 | 27.07 | 26 | 09 | 24.64 | 54 | 16.47 |
| | 24.0 | 7 | 37 | 54.43 | 25 | 40 | 09.39 | 54 | 25.41 |
| | 24.5 | 8 | 04 | 12.84 | 24 | 52 | 55.48 | 54 | 36.35 |
| | 25.0 | 8 | 30 | 17.46 | +23 | 48 | 12.16 | 54 | 49.38 |
| | 25.5 | 8 | 56 | 04.84 | 22 | 26 | 40.15 | 55 | 04.54 |
| | 26.0 | 9 | 21 | 33.13 | 20 | 49 | 09.52 | 55 | 21.87 |
| | 26.5 | 9 | 46 | 42.11 | 18 | 56 | 37.63 | 55 | 41.34 |
| | 27.0 | 10 | 11 | 33.14 | 16 | 50 | 07.66 | 56 | 02.90 |
| | 27.5 | 10 | 36 | 09.11 | 14 | 30 | 47.69 | 56 | 26.43 |
| | 28.0 | 11 | 00 | 34.22 | +11 | 59 | 50.64 | 56 | 51.75 |
| | 28.5 | 11 | 24 | 53.83 | 9 | 18 | 35.01 | 57 | 18.59 |
| | 29.0 | 11 | 49 | 14.35 | 6 | 28 | 26.34 | 57 | 46.63 |
| | 29.5 | 12 | 13 | 43.00 | 3 | 30 | 59.39 | 58 | 15.42 |
| | 30.0 | 12 | 38 | 27.74 | +0 | 28 | 00.86 | 58 | 44.47 |
| | 30.5 | 13 | 03 | 37.04 | -2 | 38 | 27.70 | 59 | 13.16 |
| Dec. | 1.0 | 13 | 29 | 19.69 | -5 | 46 | 06.93 | 59 | 40.84 |
| | 1.5 | 13 | 55 | 44.45 | 8 | 52 | 17.21 | 60 | 06.77 |
| | 2.0 | 14 | 22 | 59.65 | 11 | 53 | 57.34 | 60 | 30.22 |
| | 2.5 | 14 | 51 | 12.54 | 14 | 47 | 44.95 | 60 | 50.45 |
| | 3.0 | 15 | 20 | 28.44 | 17 | 29 | 59.74 | 61 | 06.78 |
| | 3.5 | 15 | 50 | 49.72 | 19 | 56 | 50.13 | 61 | 18.64 |
| | 4.0 | 16 | 22 | 14.73 | -22 | 04 | 24.21 | 61 | 25.59 |
| | 4.5 | 16 | 54 | 36.84 | 23 | 49 | 04.59 | 61 | 27.37 |
| | 5.0 | 17 | 27 | 44.03 | 25 | 07 | 46.02 | 61 | 23.93 |
| | 5.5 | 18 | 01 | 19.27 | 25 | 58 | 13.20 | 61 | 15.41 |
| | 6.0 | 18 | 35 | 01.89 | 26 | 19 | 14.92 | 61 | 02.15 |
| | 6.5 | 19 | 08 | 29.83 | 26 | 10 | 51.13 | 60 | 44.64 |
| | 7.0 | 19 | 41 | 22.23 | -25 | 34 | 10.81 | 60 | 23.51 |
| | 7.5 | 20 | 13 | 21.71 | 24 | 31 | 21.19 | 59 | 59.46 |
| | 8.0 | 20 | 44 | 15.80 | 23 | 05 | 11.14 | 59 | 33.22 |
| | 8.5 | 21 | 13 | 57.43 | 21 | 18 | 52.88 | 59 | 05.53 |
| | 9.0 | 21 | 42 | 24.54 | -19 | 15 | 45.38 | 58 | 37.08 |

**MOON, 2021**
FOR $0^h$ AND $12^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | Horizontal Parallax | |
|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | ' | " |
| Dec. | 9.0 | 21 | 42 | 24.54 | -19 | 15 | 45.38 | 58 | 37.08 |
| | 9.5 | 22 | 09 | 39.18 | 16 | 59 | 01.65 | 58 | 08.50 |
| | 10.0 | 22 | 35 | 46.38 | 14 | 31 | 40.65 | 57 | 40.35 |
| | 10.5 | 23 | 00 | 53.23 | 11 | 56 | 23.14 | 57 | 13.09 |
| | 11.0 | 23 | 25 | 07.93 | 9 | 15 | 30.80 | 56 | 47.10 |
| | 11.5 | 23 | 48 | 39.26 | 6 | 31 | 07.32 | 56 | 22.67 |
| | 12.0 | 0 | 11 | 36.12 | -3 | 45 | 00.76 | 56 | 00.03 |
| | 12.5 | 0 | 34 | 07.27 | +0 | 58 | 46.42 | 55 | 39.32 |
| | 13.0 | 0 | 56 | 21.14 | 1 | 46 | 10.07 | 55 | 20.63 |
| | 13.5 | 1 | 18 | 25.78 | 4 | 28 | 29.92 | 55 | 03.99 |
| | 14.0 | 1 | 40 | 28.76 | 7 | 06 | 58.51 | 54 | 49.40 |
| | 14.5 | 2 | 02 | 37.15 | 9 | 40 | 23.18 | 54 | 36.81 |
| | 15.0 | 2 | 24 | 57.40 | +12 | 07 | 31.46 | 54 | 26.16 |
| | 15.5 | 2 | 47 | 35.30 | 14 | 27 | 09.73 | 54 | 17.37 |
| | 16.0 | 3 | 10 | 35.82 | 16 | 38 | 02.47 | 54 | 10.35 |
| | 16.5 | 3 | 34 | 02.97 | 18 | 38 | 52.13 | 54 | 04.99 |
| | 17.0 | 3 | 57 | 59.58 | 20 | 28 | 19.66 | 54 | 01.20 |
| | 17.5 | 4 | 22 | 27.16 | 22 | 05 | 05.73 | 53 | 58.89 |
| | 18.0 | 4 | 47 | 25.65 | +23 | 27 | 52.73 | 53 | 57.96 |
| | 18.5 | 5 | 12 | 53.33 | 24 | 35 | 27.40 | 53 | 58.37 |
| | 19.0 | 5 | 38 | 46.78 | 25 | 26 | 43.96 | 54 | 00.04 |
| | 19.5 | 6 | 05 | 01.02 | 26 | 00 | 47.37 | 54 | 02.95 |
| | 20.0 | 6 | 31 | 29.73 | 26 | 16 | 56.44 | 54 | 07.07 |
| | 20.5 | 6 | 58 | 05.73 | 26 | 14 | 46.33 | 54 | 12.42 |
| | 21.0 | 7 | 24 | 41.54 | +25 | 54 | 10.00 | 54 | 19.01 |
| | 21.5 | 7 | 51 | 09.92 | 25 | 15 | 18.46 | 54 | 26.87 |
| | 22.0 | 8 | 17 | 24.50 | 24 | 18 | 39.80 | 54 | 36.05 |
| | 22.5 | 8 | 43 | 20.23 | 23 | 04 | 57.10 | 54 | 46.61 |
| | 23.0 | 9 | 08 | 53.67 | 21 | 35 | 05.77 | 54 | 58.61 |
| | 23.5 | 9 | 34 | 03.17 | 19 | 50 | 10.58 | 55 | 12.12 |
| | 24.0 | 9 | 58 | 48.85 | +17 | 51 | 22.86 | 55 | 27.17 |
| | 24.5 | 10 | 23 | 12.53 | 15 | 39 | 58.26 | 55 | 43.82 |
| | 25.0 | 10 | 47 | 17.53 | 13 | 17 | 15.20 | 56 | 02.06 |
| | 25.5 | 11 | 11 | 08.49 | 10 | 44 | 34.19 | 56 | 21.87 |
| | 26.0 | 11 | 34 | 51.20 | 8 | 03 | 17.94 | 56 | 43.19 |
| | 26.5 | 11 | 58 | 32.38 | 5 | 14 | 52.39 | 57 | 05.91 |
| | 27.0 | 12 | 22 | 19.61 | +2 | 20 | 48.36 | 57 | 29.84 |
| | 27.5 | 12 | 46 | 21.11 | +0 | 37 | 16.10 | 57 | 54.74 |
| | 28.0 | 13 | 10 | 45.66 | -3 | 37 | 32.88 | 58 | 20.29 |
| | 28.5 | 13 | 35 | 42.39 | 6 | 38 | 00.74 | 58 | 46.08 |
| | 29.0 | 14 | 01 | 20.54 | 9 | 36 | 22.24 | 59 | 11.63 |
| | 29.5 | 14 | 27 | 49.10 | 12 | 30 | 01.20 | 59 | 36.38 |
| | 30.0 | 14 | 55 | 16.25 | -15 | 16 | 01.24 | 59 | 59.71 |
| | 30.5 | 15 | 23 | 48.56 | 17 | 51 | 06.40 | 60 | 20.98 |
| | 31.0 | 15 | 53 | 30.09 | 20 | 11 | 44.67 | 60 | 39.52 |
| | 31.5 | 16 | 24 | 21.17 | 22 | 14 | 15.68 | 60 | 54.67 |
| | 32.0 | 16 | 56 | 17.32 | -23 | 55 | 02.91 | 61 | 05.87 |

**MOON, 2021**
AT EPHEMERIS TRANSIT

| Date | | Age (at $0^h$) | | Ephemeris Transit | | | Geocentric Declination | |
|---|---|---|---|---|---|---|---|---|
| | | d | | d | h | m | ° | ' |
| Jan. | 0 | 16.32 | U | 31 | 00 | 49.5 | +24 | 32.4 |
| | 0 | | L | 31 | 13 | 16.7 | 23 | 52.6 |
| | 1 | 17.32 | U | 1 | 01 | 43.8 | 22 | 51.8 |
| | 1 | | L | 1 | 14 | 10.6 | 21 | 30.7 |
| | 2 | 18.32 | U | 2 | 02 | 37.1 | 19 | 50.5 |
| | 2 | | L | 2 | 15 | 03.1 | +17 | 52.9 |
| | 3 | 19.32 | U | 3 | 03 | 28.6 | 15 | 39.7 |
| | 3 | | L | 3 | 15 | 53.7 | 13 | 13.0 |
| | 4 | 20.32 | U | 4 | 04 | 18.4 | 10 | 34.7 |
| | 4 | | L | 4 | 16 | 42.7 | 7 | 47.0 |
| | 5 | 21.32 | U | 5 | 05 | 06.9 | +4 | 52.2 |
| | 5 | | L | 5 | 17 | 31.0 | +1 | 52.5 |
| | 6 | 22.32 | U | 6 | 05 | 55.2 | -1 | 09.8 |
| | 6 | | L | 6 | 18 | 19.6 | 4 | 12.3 |
| | 7 | 23.32 | U | 7 | 06 | 44.4 | 7 | 12.5 |
| | 7 | | L | 7 | 19 | 09.7 | -10 | 07.8 |
| | 8 | 24.32 | U | 8 | 07 | 35.7 | 12 | 55.4 |
| | 8 | | L | 8 | 20 | 02.3 | 15 | 32.3 |
| | 9 | 25.32 | U | 9 | 08 | 29.8 | 17 | 55.5 |
| | 9 | | L | 9 | 20 | 58.2 | 20 | 01.8 |
| | 10 | 26.32 | U | 10 | 09 | 27.3 | -21 | 48.2 |
| | 10 | | L | 10 | 21 | 57.1 | 23 | 12.2 |
| | 11 | 27.32 | U | 11 | 10 | 27.4 | 24 | 11.5 |
| | 11 | | L | 11 | 22 | 57.9 | 24 | 44.8 |
| | 12 | 28.32 | U | 12 | 11 | 28.5 | 24 | 51.4 |
| | 12 | | L | 12 | 23 | 58.6 | -24 | 31.7 |
| | 13 | 29.32 | U | 13 | 12 | 28.3 | 23 | 47.1 |
| | 14 | 0.79 | L | 14 | 00 | 57.0 | 22 | 39.6 |
| | 14 | | U | 14 | 13 | 24.8 | 21 | 11.8 |
| | 15 | 1.79 | L | 15 | 01 | 51.6 | 19 | 26.3 |
| | 15 | | U | 15 | 14 | 17.2 | -17 | 26.4 |
| | 16 | 2.79 | L | 16 | 02 | 41.8 | 15 | 14.5 |
| | 16 | | U | 16 | 15 | 05.4 | 12 | 53.5 |
| | 17 | 3.79 | L | 17 | 03 | 28.1 | 10 | 25.6 |
| | 17 | | U | 17 | 15 | 50.1 | 7 | 52.9 |
| | 18 | 4.79 | L | 18 | 04 | 11.5 | -5 | 17.3 |
| | 18 | | U | 18 | 16 | 32.4 | 2 | 40.3 |
| | 19 | 5.79 | L | 19 | 04 | 53.0 | -0 | 03.3 |
| | 19 | | U | 19 | 17 | 13.3 | +2 | 32.5 |
| | 20 | 6.79 | L | 20 | 05 | 33.7 | 5 | 05.7 |
| | 20 | | U | 20 | 17 | 54.0 | +7 | 35.4 |
| | 21 | 7.79 | L | 21 | 06 | 14.6 | 10 | 00.4 |
| | 21 | | U | 21 | 18 | 35.5 | 12 | 19.5 |
| | 22 | 8.79 | L | 22 | 06 | 56.9 | +14 | 31.5 |

| Date | | Age (at $0^h$) | | Ephemeris Transit | | | Geocentric Declination | |
|---|---|---|---|---|---|---|---|---|
| | | d | | d | h | m | ° | ' |
| Jan. | 22 | | U | 22 | 19 | 18.8 | +16 | 35.1 |
| | 23 | 9.79 | L | 23 | 07 | 41.3 | 18 | 28.9 |
| | 23 | | U | 23 | 20 | 04.5 | 20 | 11.2 |
| | 24 | 10.79 | L | 24 | 08 | 28.5 | 21 | 40.4 |
| | 24 | | U | 24 | 20 | 53.2 | 22 | 54.7 |
| | 25 | 11.79 | L | 25 | 09 | 18.8 | +23 | 52.5 |
| | 25 | | U | 25 | 21 | 44.9 | 24 | 32.0 |
| | 26 | 12.79 | L | 26 | 10 | 11.7 | 24 | 51.6 |
| | 26 | | U | 26 | 22 | 38.9 | 24 | 50.3 |
| | 27 | 13.79 | L | 27 | 11 | 06.4 | 24 | 27.2 |
| | 27 | | U | 27 | 23 | 34.0 | +23 | 42.0 |
| | 28 | 14.79 | L | 28 | 12 | 01.6 | 22 | 35.0 |
| | 29 | 15.79 | U | 29 | 00 | 28.8 | 21 | 07.0 |
| | 29 | | L | 29 | 12 | 55.8 | 19 | 19.3 |
| | 30 | 16.79 | U | 30 | 01 | 22.3 | 17 | 13.7 |
| | 30 | | L | 30 | 13 | 48.3 | +14 | 52.2 |
| | 31 | 17.79 | U | 31 | 02 | 13.9 | 12 | 17.1 |
| | 31 | | L | 31 | 14 | 39.0 | 9 | 30.9 |
| Feb. | 1 | 18.79 | U | 1 | 03 | 03.8 | 6 | 36.2 |
| | 1 | | L | 1 | 15 | 28.4 | 3 | 35.6 |
| | 2 | 19.79 | U | 2 | 03 | 52.9 | +0 | 31.6 |
| | 2 | | L | 2 | 16 | 17.4 | -2 | 33.2 |
| | 3 | 20.79 | U | 3 | 04 | 42.0 | 5 | 36.1 |
| | 3 | | L | 3 | 17 | 07.0 | 8 | 34.6 |
| | 4 | 21.79 | U | 4 | 05 | 32.3 | 11 | 26.1 |
| | 4 | | L | 4 | 17 | 58.2 | -14 | 07.8 |
| | 5 | 22.79 | U | 5 | 06 | 24.7 | 16 | 37.1 |
| | 5 | | L | 5 | 18 | 51.9 | 18 | 51.3 |
| | 6 | 23.79 | U | 6 | 07 | 19.8 | 20 | 47.7 |
| | 6 | | L | 6 | 19 | 48.4 | 22 | 24.1 |
| | 7 | 24.79 | U | 7 | 08 | 17.5 | -23 | 38.3 |
| | 7 | | L | 7 | 20 | 47.0 | 24 | 28.6 |
| | 8 | 25.79 | U | 8 | 09 | 16.6 | 24 | 53.9 |
| | 8 | | L | 8 | 21 | 46.3 | 24 | 53.9 |
| | 9 | 26.79 | U | 9 | 10 | 15.6 | 24 | 29.2 |
| | 9 | | L | 9 | 22 | 44.4 | -23 | 40.6 |
| | 10 | 27.79 | U | 10 | 11 | 12.6 | 22 | 30.2 |
| | 10 | | L | 10 | 23 | 39.8 | 20 | 60.0 |
| | 11 | 28.79 | U | 11 | 12 | 06.1 | 19 | 12.6 |
| | 12 | 0.20 | L | 12 | 00 | 31.5 | 17 | 10.7 |
| | 12 | | U | 12 | 12 | 55.9 | -14 | 56.8 |
| | 13 | 1.20 | L | 13 | 01 | 19.4 | 12 | 33.6 |
| | 13 | | U | 13 | 13 | 42.2 | 10 | 03.2 |
| | 14 | 2.20 | L | 14 | 02 | 04.3 | -7 | 27.9 |

# MOON, 2021
## AT EPHEMERIS TRANSIT

| Date | | Age (at $0^h$) | | Ephemeris Transit | | | Geocentric Declination | |
|---|---|---|---|---|---|---|---|---|
| | | d | | d | h | m | ° | ' |
| Feb. | 14 | | U | 14 | 14 | 25.8 | -4 | 49.6 |
| | 15 | 3.20 | L | 15 | 02 | 46.9 | -2 | 10.0 |
| | 15 | | U | 15 | 15 | 07.6 | +0 | 29.3 |
| | 16 | 4.20 | L | 16 | 03 | 28.2 | 3 | 07.0 |
| | 16 | | U | 16 | 15 | 48.7 | 5 | 41.7 |
| | 17 | 5.20 | L | 17 | 04 | 09.2 | +8 | 12.1 |
| | 17 | | U | 17 | 16 | 30.0 | 10 | 37.2 |
| | 18 | 6.20 | L | 18 | 04 | 51.0 | 12 | 55.7 |
| | 18 | | U | 18 | 17 | 12.4 | 15 | 06.4 |
| | 19 | 7.20 | L | 19 | 05 | 34.3 | 17 | 08.1 |
| | 19 | | U | 19 | 17 | 56.8 | +18 | 59.2 |
| | 20 | 8.20 | L | 20 | 06 | 19.9 | 20 | 38.5 |
| | 20 | | U | 20 | 18 | 43.8 | 22 | 04.4 |
| | 21 | 9.20 | L | 21 | 07 | 08.3 | 23 | 15.3 |
| | 21 | | U | 21 | 19 | 33.6 | 24 | 09.6 |
| | 22 | 10.20 | L | 22 | 07 | 59.5 | +24 | 45.8 |
| | 22 | | U | 22 | 20 | 26.0 | 25 | 02.4 |
| | 23 | 11.20 | L | 23 | 08 | 53.0 | 24 | 58.2 |
| | 23 | | U | 23 | 21 | 20.3 | 24 | 32.4 |
| | 24 | 12.20 | L | 24 | 09 | 47.8 | 23 | 44.5 |
| | 24 | | U | 24 | 22 | 15.3 | +22 | 34.7 |
| | 25 | 13.20 | L | 25 | 10 | 42.6 | 21 | 03.5 |
| | 25 | | U | 25 | 23 | 09.8 | 19 | 11.9 |
| | 26 | 14.20 | L | 26 | 11 | 36.5 | 17 | 01.6 |
| | 27 | 15.20 | U | 27 | 00 | 03.0 | 14 | 34.4 |
| | 27 | | L | 27 | 12 | 29.1 | +11 | 52.9 |
| | 28 | 16.20 | U | 28 | 00 | 54.8 | 8 | 59.5 |
| | 28 | | L | 28 | 13 | 20.3 | 5 | 57.1 |
| Mar. | 1 | 17.20 | U | 1 | 01 | 45.6 | +2 | 48.6 |
| | 1 | | L | 1 | 14 | 10.9 | -0 | 23.0 |
| | 2 | 18.20 | U | 2 | 02 | 36.2 | -3 | 34.7 |
| | 2 | | L | 2 | 15 | 01.7 | 6 | 43.2 |
| | 3 | 19.20 | U | 3 | 03 | 27.5 | 9 | 45.7 |
| | 3 | | L | 3 | 15 | 53.8 | 12 | 39.0 |
| | 4 | 20.20 | U | 4 | 04 | 20.4 | 15 | 20.3 |
| | 4 | | L | 4 | 16 | 47.7 | -17 | 46.7 |
| | 5 | 21.20 | U | 5 | 05 | 15.5 | 19 | 55.6 |
| | 5 | | L | 5 | 17 | 43.9 | 21 | 44.7 |
| | 6 | 22.20 | U | 6 | 06 | 12.7 | 23 | 12.0 |
| | 6 | | L | 6 | 18 | 41.9 | 24 | 15.8 |
| | 7 | 23.20 | U | 7 | 07 | 11.2 | -24 | 55.1 |
| | 7 | | L | 7 | 19 | 40.5 | 25 | 09.5 |
| | 8 | 24.20 | U | 8 | 08 | 09.6 | 24 | 59.3 |
| | 8 | | L | 8 | 20 | 38.2 | -24 | 25.3 |

| Date | | Age (at $0^h$) | | Ephemeris Transit | | | Geocentric Declination | |
|---|---|---|---|---|---|---|---|---|
| | | d | | d | h | m | ° | ' |
| Mar. | 9 | 25.20 | U | 9 | 09 | 06.2 | -23 | 29.0 |
| | 9 | | L | 9 | 21 | 33.4 | 22 | 12.2 |
| | 10 | 26.20 | U | 10 | 09 | 59.8 | 20 | 37.1 |
| | 10 | | L | 10 | 22 | 25.3 | 18 | 46.0 |
| | 11 | 27.20 | U | 11 | 10 | 49.9 | 16 | 41.4 |
| | 11 | | L | 11 | 23 | 13.7 | -14 | 25.5 |
| | 12 | 28.20 | U | 12 | 11 | 36.7 | 12 | 00.7 |
| | 12 | | L | 12 | 23 | 59.0 | 9 | 28.9 |
| | 13 | 29.20 | U | 13 | 12 | 20.8 | 6 | 52.4 |
| | 14 | 0.57 | L | 14 | 00 | 42.1 | 4 | 12.8 |
| | 14 | | U | 14 | 13 | 03.0 | -1 | 32.0 |
| | 15 | 1.57 | L | 15 | 01 | 23.7 | +1 | 08.6 |
| | 15 | | U | 15 | 13 | 44.3 | 3 | 47.4 |
| | 16 | 2.57 | L | 16 | 02 | 04.8 | 6 | 23.0 |
| | 16 | | U | 16 | 14 | 25.5 | 8 | 54.1 |
| | 17 | 3.57 | L | 17 | 02 | 46.3 | +11 | 19.4 |
| | 17 | | U | 17 | 15 | 07.5 | 13 | 37.5 |
| | 18 | 4.57 | L | 18 | 03 | 29.0 | 15 | 47.3 |
| | 18 | | U | 18 | 15 | 51.0 | 17 | 47.3 |
| | 19 | 5.57 | L | 19 | 04 | 13.5 | 19 | 36.2 |
| | 19 | | U | 19 | 16 | 36.6 | +21 | 12.7 |
| | 20 | 6.57 | L | 20 | 05 | 00.4 | 22 | 35.2 |
| | 20 | | U | 20 | 17 | 24.8 | 23 | 42.4 |
| | 21 | 7.57 | L | 21 | 05 | 49.8 | 24 | 32.9 |
| | 21 | | U | 21 | 18 | 15.4 | 25 | 05.2 |
| | 22 | 8.57 | L | 22 | 06 | 41.4 | +25 | 18.4 |
| | 22 | | U | 22 | 19 | 07.9 | 25 | 11.2 |
| | 23 | 9.57 | L | 23 | 07 | 34.6 | 24 | 43.1 |
| | 23 | | U | 23 | 20 | 01.5 | 23 | 53.7 |
| | 24 | 10.57 | L | 24 | 08 | 28.4 | 22 | 43.0 |
| | 24 | | U | 24 | 20 | 55.3 | +21 | 11.3 |
| | 25 | 11.57 | L | 25 | 09 | 22.0 | 19 | 19.6 |
| | 25 | | U | 25 | 21 | 48.4 | 17 | 09.0 |
| | 26 | 12.57 | L | 26 | 10 | 14.7 | 14 | 41.2 |
| | 26 | | U | 26 | 22 | 40.7 | 11 | 58.3 |
| | 27 | 13.57 | L | 27 | 11 | 06.5 | +9 | 02.4 |
| | 27 | | U | 27 | 23 | 32.2 | 5 | 56.3 |
| | 28 | 14.57 | L | 28 | 11 | 57.9 | +2 | 43.0 |
| | 29 | 15.57 | U | 29 | 00 | 23.7 | -0 | 34.5 |
| | 29 | | L | 29 | 12 | 49.7 | 3 | 52.8 |
| | 30 | 16.57 | U | 30 | 01 | 16.0 | -7 | 08.4 |
| | 30 | | L | 30 | 13 | 42.8 | 10 | 17.6 |
| | 31 | 17.57 | U | 31 | 02 | 10.1 | 13 | 17.0 |
| | 31 | | L | 31 | 14 | 37.9 | -16 | 02.9 |

**MOON, 2021**
AT EPHEMERIS TRANSIT

| Date | | Age (at $0^h$) | | Ephemeris Transit | | | Geocentric Declination | |
|---|---|---|---|---|---|---|---|---|
| | | d | | d | h | m | ° | ' |
| Apr. | 1 | 18.57 | U | 1 | 03 | 06.3 | -18 | 32.0 |
| | 1 | | L | 1 | 15 | 35.4 | 20 | 41.4 |
| | 2 | 19.57 | U | 2 | 04 | 04.9 | 22 | 28.4 |
| | 2 | | L | 2 | 16 | 34.8 | 23 | 51.1 |
| | 3 | 20.57 | U | 3 | 05 | 04.9 | 24 | 48.1 |
| | 3 | | L | 3 | 17 | 34.9 | -25 | 18.8 |
| | 4 | 21.57 | U | 4 | 06 | 04.6 | 25 | 23.5 |
| | 4 | | L | 4 | 18 | 33.9 | 25 | 03.0 |
| | 5 | 22.57 | U | 5 | 07 | 02.4 | 24 | 18.9 |
| | 5 | | L | 5 | 19 | 30.1 | 23 | 13.2 |
| | 6 | 23.57 | U | 6 | 07 | 57.0 | -21 | 48.1 |
| | 6 | | L | 6 | 20 | 22.8 | 20 | 06.0 |
| | 7 | 24.57 | U | 7 | 08 | 47.7 | 18 | 09.4 |
| | 7 | | L | 7 | 21 | 11.6 | 16 | 00.4 |
| | 8 | 25.57 | U | 8 | 09 | 34.8 | 13 | 41.5 |
| | 8 | | L | 8 | 21 | 57.2 | -11 | 14.6 |
| | 9 | 26.57 | U | 9 | 10 | 19.0 | 8 | 41.6 |
| | 9 | | L | 9 | 22 | 40.2 | 6 | 04.4 |
| | 10 | 27.57 | U | 10 | 11 | 01.1 | 3 | 24.5 |
| | 10 | | L | 10 | 23 | 21.7 | -0 | 43.7 |
| | 11 | 28.57 | U | 11 | 11 | 42.2 | +1 | 56.8 |
| | 12 | 29.57 | L | 12 | 00 | 02.6 | 4 | 35.3 |
| | 12 | | U | 12 | 12 | 23.0 | 7 | 10.6 |
| | 13 | 0.90 | L | 13 | 00 | 43.7 | 9 | 41.1 |
| | 13 | | U | 13 | 13 | 04.5 | 12 | 05.7 |
| | 14 | 1.90 | L | 14 | 01 | 25.8 | +14 | 22.8 |
| | 14 | | U | 14 | 13 | 47.4 | 16 | 31.1 |
| | 15 | 2.90 | L | 15 | 02 | 09.6 | 18 | 29.2 |
| | 15 | | U | 15 | 14 | 32.3 | 20 | 15.5 |
| | 16 | 3.90 | L | 16 | 02 | 55.6 | 21 | 48.8 |
| | 16 | | U | 16 | 15 | 19.4 | +23 | 07.6 |
| | 17 | 4.90 | L | 17 | 03 | 43.8 | 24 | 10.4 |
| | 17 | | U | 17 | 16 | 08.7 | 24 | 56.2 |
| | 18 | 5.90 | L | 18 | 04 | 34.1 | 25 | 23.7 |
| | 18 | | U | 18 | 16 | 59.9 | 25 | 32.0 |
| | 19 | 6.90 | L | 19 | 05 | 25.9 | +25 | 20.5 |
| | 19 | | U | 19 | 17 | 52.1 | 24 | 48.6 |
| | 20 | 7.90 | L | 20 | 06 | 18.3 | 23 | 56.4 |
| | 20 | | U | 20 | 18 | 44.5 | 22 | 43.9 |
| | 21 | 8.90 | L | 21 | 07 | 10.5 | 21 | 11.6 |
| | 21 | | U | 21 | 19 | 36.4 | +19 | 20.5 |
| | 22 | 9.90 | L | 22 | 08 | 02.0 | 17 | 11.5 |
| | 22 | | U | 22 | 20 | 27.5 | 14 | 46.0 |
| | 23 | 10.90 | L | 23 | 08 | 52.8 | +12 | 05.7 |

| Date | | Age (at $0^h$) | | Ephemeris Transit | | | Geocentric Declination | |
|---|---|---|---|---|---|---|---|---|
| | | d | | d | h | m | ° | ' |
| Apr. | 23 | | U | 23 | 21 | 18.0 | +9 | 12.5 |
| | 24 | 11.90 | L | 24 | 09 | 43.2 | 6 | 08.5 |
| | 24 | | U | 24 | 22 | 08.6 | +2 | 56.4 |
| | 25 | 12.90 | L | 25 | 10 | 34.1 | -0 | 21.1 |
| | 25 | | U | 25 | 23 | 00.1 | 3 | 40.8 |
| | 26 | 13.90 | L | 26 | 11 | 26.5 | -6 | 59.2 |
| | 26 | | U | 26 | 23 | 53.5 | 10 | 12.6 |
| | 27 | 14.90 | L | 27 | 12 | 21.3 | 13 | 17.0 |
| | 28 | 15.90 | U | 28 | 00 | 49.8 | 16 | 08.4 |
| | 28 | | L | 28 | 13 | 19.2 | 18 | 42.8 |
| | 29 | 16.90 | U | 29 | 01 | 49.2 | -20 | 56.6 |
| | 29 | | L | 29 | 14 | 20.0 | 22 | 46.5 |
| | 30 | 17.90 | U | 30 | 02 | 51.1 | 24 | 10.0 |
| | 30 | | L | 30 | 15 | 22.4 | 25 | 05.6 |
| May | 1 | 18.90 | U | 1 | 03 | 53.6 | 25 | 32.6 |
| | 1 | | L | 1 | 16 | 24.4 | -25 | 31.6 |
| | 2 | 19.90 | U | 2 | 04 | 54.5 | 25 | 04.0 |
| | 2 | | L | 2 | 17 | 23.7 | 24 | 11.8 |
| | 3 | 20.90 | U | 3 | 05 | 51.9 | 22 | 57.6 |
| | 3 | | L | 3 | 18 | 18.9 | 21 | 24.3 |
| | 4 | 21.90 | U | 4 | 06 | 44.9 | -19 | 34.5 |
| | 4 | | L | 4 | 19 | 09.7 | 17 | 31.2 |
| | 5 | 22.90 | U | 5 | 07 | 33.5 | 15 | 16.7 |
| | 5 | | L | 5 | 19 | 56.4 | 12 | 53.4 |
| | 6 | 23.90 | U | 6 | 08 | 18.5 | 10 | 23.3 |
| | 6 | | L | 6 | 20 | 40.0 | -7 | 48.2 |
| | 7 | 24.90 | U | 7 | 09 | 01.0 | 5 | 09.8 |
| | 7 | | L | 7 | 21 | 21.6 | -2 | 29.5 |
| | 8 | 25.90 | U | 8 | 09 | 41.9 | +0 | 11.1 |
| | 8 | | L | 8 | 22 | 02.2 | 2 | 50.8 |
| | 9 | 26.90 | U | 9 | 10 | 22.4 | +5 | 28.2 |
| | 9 | | L | 9 | 22 | 42.8 | 8 | 02.0 |
| | 10 | 27.90 | U | 10 | 11 | 03.4 | 10 | 30.9 |
| | 10 | | L | 10 | 23 | 24.3 | 12 | 53.5 |
| | 11 | 28.90 | U | 11 | 11 | 45.6 | 15 | 08.4 |
| | 12 | 0.21 | L | 12 | 00 | 07.4 | +17 | 14.2 |
| | 12 | | U | 12 | 12 | 29.7 | 19 | 09.3 |
| | 13 | 1.21 | L | 13 | 00 | 52.7 | 20 | 52.2 |
| | 13 | | U | 13 | 13 | 16.2 | 22 | 21.5 |
| | 14 | 2.21 | L | 14 | 01 | 40.3 | 23 | 35.7 |
| | 14 | | U | 14 | 14 | 04.9 | +24 | 33.4 |
| | 15 | 3.21 | L | 15 | 02 | 30.0 | 25 | 13.5 |
| | 15 | | U | 15 | 14 | 55.4 | 25 | 34.9 |
| | 16 | 4.21 | L | 16 | 03 | 21.2 | +25 | 36.9 |

## MOON, 2021
AT EPHEMERIS TRANSIT

| Date | | Age (at $0^h$) | | Ephemeris Transit | | | Geocentric Declination | |
|---|---|---|---|---|---|---|---|---|
| | | d | | d | h | m | ° | ' |
| May | 16 | | U | 16 | 15 | 47.0 | +25 | 19.0 |
| | 17 | 5.21 | L | 17 | 04 | 12.9 | 24 | 41.2 |
| | 17 | | U | 17 | 16 | 38.7 | 23 | 43.6 |
| | 18 | 6.21 | L | 18 | 05 | 04.4 | 22 | 26.8 |
| | 18 | | U | 18 | 17 | 29.8 | 20 | 51.5 |
| | 19 | 7.21 | L | 19 | 05 | 54.8 | +18 | 58.6 |
| | 19 | | U | 19 | 18 | 19.7 | 16 | 49.5 |
| | 20 | 8.21 | L | 20 | 06 | 44.2 | 14 | 25.4 |
| | 20 | | U | 20 | 19 | 08.6 | 11 | 47.8 |
| | 21 | 9.21 | L | 21 | 07 | 32.9 | 8 | 58.5 |
| | 21 | | U | 21 | 19 | 57.3 | +5 | 59.2 |
| | 22 | 10.21 | L | 22 | 08 | 21.7 | +2 | 52.2 |
| | 22 | | U | 22 | 20 | 46.5 | -0 | 20.2 |
| | 23 | 11.21 | L | 23 | 09 | 11.7 | 3 | 35.3 |
| | 23 | | U | 23 | 21 | 37.4 | 6 | 50.2 |
| | 24 | 12.21 | L | 24 | 10 | 04.0 | -10 | 01.3 |
| | 24 | | U | 24 | 22 | 31.3 | 13 | 05.1 |
| | 25 | 13.21 | L | 25 | 10 | 59.7 | 15 | 57.3 |
| | 25 | | U | 25 | 23 | 29.0 | 18 | 34.0 |
| | 26 | 14.21 | L | 26 | 11 | 59.3 | 20 | 50.8 |
| | 27 | 15.21 | U | 27 | 00 | 30.4 | -22 | 44.2 |
| | 27 | | L | 27 | 13 | 02.3 | 24 | 10.8 |
| | 28 | 16.21 | U | 28 | 01 | 34.4 | 25 | 08.6 |
| | 28 | | L | 28 | 14 | 06.6 | 25 | 36.2 |
| | 29 | 17.21 | U | 29 | 02 | 38.5 | 25 | 34.1 |
| | 29 | | L | 29 | 15 | 09.6 | -25 | 03.5 |
| | 30 | 18.21 | U | 30 | 03 | 39.9 | 24 | 06.7 |
| | 30 | | L | 30 | 16 | 08.9 | 22 | 46.9 |
| | 31 | 19.21 | U | 31 | 04 | 36.7 | 21 | 07.0 |
| | 31 | | L | 31 | 17 | 03.2 | 19 | 10.6 |
| June | 1 | 20.21. | U | 1 | 05 | 28.5 | -17 | 00.7 |
| | 1 | | L | 1 | 17 | 52.6 | 14 | 40.2 |
| | 2 | 21.21 | U | 2 | 06 | 15.8 | 12 | 11.5 |
| | 2 | | L | 2 | 18 | 38.1 | 9 | 37.0 |
| | 3 | 22.21 | U | 3 | 06 | 59.6 | 6 | 58.5 |
| | 3 | | L | 3 | 19 | 20.7 | -4 | 17.6 |
| | 4 | 23.21 | U | 4 | 07 | 41.3 | -1 | 35.9 |
| | 4 | | L | 4 | 20 | 01.7 | +1 | 05.2 |
| | 5 | 24.21 | U | 5 | 08 | 21.9 | 3 | 44.6 |
| | 5 | | L | 5 | 20 | 42.2 | 6 | 21.0 |
| | 6 | 25.21 | U | 6 | 09 | 02.6 | +8 | 53.2 |
| | 6 | | L | 6 | 21 | 23.2 | 11 | 20.0 |
| | 7 | 26.21 | U | 7 | 09 | 44.2 | 13 | 40.0 |
| | 7 | | L | 7 | 22 | 05.6 | +15 | 51.9 |

| Date | | Age (at $0^h$) | | Ephemeris Transit | | | Geocentric Declination | |
|---|---|---|---|---|---|---|---|---|
| | | d | | d | h | m | ° | ' |
| June | 8 | 27.21 | U | 8 | 10 | 27.6 | +17 | 54.3 |
| | 8 | | L | 8 | 22 | 50.1 | 19 | 45.6 |
| | 9 | 28.21 | U | 9 | 11 | 13.3 | 21 | 24.3 |
| | 9 | | L | 9 | 23 | 37.1 | 22 | 48.9 |
| | 10 | 29.21 | U | 10 | 12 | 01.5 | 23 | 57.8 |
| | 11 | 0.55 | L | 11 | 00 | 26.4 | +24 | 49.7 |
| | 11 | | U | 11 | 12 | 51.8 | 25 | 23.3 |
| | 12 | 1.55 | L | 12 | 01 | 17.5 | 25 | 37.8 |
| | 12 | | U | 12 | 13 | 43.5 | 25 | 32.3 |
| | 13 | 2.55 | L | 13 | 02 | 09.4 | 25 | 06.8 |
| | 13 | | U | 13 | 14 | 35.4 | +24 | 21.3 |
| | 14 | 3.55 | L | 14 | 03 | 01.1 | 23 | 16.3 |
| | 14 | | U | 14 | 15 | 26.6 | 21 | 52.6 |
| | 15 | 4.55 | L | 15 | 03 | 51.6 | 20 | 11.2 |
| | 15 | | U | 15 | 16 | 16.4 | 18 | 13.4 |
| | 16 | 5.55 | L | 16 | 04 | 40.7 | +16 | 00.7 |
| | 16 | | U | 16 | 17 | 04.7 | 13 | 34.6 |
| | 17 | 6.55 | L | 17 | 05 | 28.5 | 10 | 56.7 |
| | 17 | | U | 17 | 17 | 52.1 | 8 | 08.7 |
| | 18 | 7.55 | L | 18 | 06 | 15.7 | 5 | 12.4 |
| | 18 | | U | 18 | 18 | 39.4 | +2 | 09.8 |
| | 19 | 8.55 | L | 19 | 07 | 03.3 | -0 | 56.9 |
| | 19 | | U | 19 | 19 | 27.6 | 4 | 05.6 |
| | 20 | 9.55 | L | 20 | 07 | 52.5 | 7 | 13.4 |
| | 20 | | U | 20 | 20 | 18.2 | 10 | 17.7 |
| | 21 | 10.55 | L | 21 | 08 | 44.7 | -13 | 15.0 |
| | 21 | | U | 21 | 21 | 12.2 | 16 | 01.9 |
| | 22 | 11.55 | L | 22 | 09 | 40.9 | 18 | 34.4 |
| | 22 | | U | 22 | 22 | 10.5 | 20 | 48.8 |
| | 23 | 12.55 | L | 23 | 10 | 41.3 | 22 | 40.9 |
| | 23 | | U | 23 | 23 | 12.8 | -24 | 07.7 |
| | 24 | 13.55 | L | 24 | 11 | 44.9 | 25 | 06.1 |
| | 25 | 14.55 | U | 25 | 00 | 17.3 | 25 | 34.8 |
| | 25 | | L | 25 | 12 | 49.5 | 25 | 33.2 |
| | 26 | 15.55 | U | 26 | 01 | 21.2 | 25 | 02.2 |
| | 26 | | L | 26 | 13 | 52.0 | -24 | 04.1 |
| | 27 | 16.55 | U | 27 | 02 | 21.8 | 22 | 41.4 |
| | 27 | | L | 27 | 14 | 50.2 | 20 | 57.8 |
| | 28 | 17.55 | U | 28 | 03 | 17.5 | 18 | 56.6 |
| | 28 | | L | 28 | 15 | 43.4 | 16 | 41.5 |
| | 29 | 18.55 | U | 29 | 04 | 08.1 | -14 | 15.5 |
| | 29 | | L | 29 | 16 | 31.8 | 11 | 41.5 |
| | 30 | 19.55 | U | 30 | 04 | 54.6 | 9 | 02.0 |
| | 30 | | L | 30 | 17 | 16.6 | -6 | 19.1 |

**MOON, 2021**
AT EPHEMERIS TRANSIT

| Date | | Age (at $0^h$) | | Ephemeris Transit | | | Geocentric Declination | |
|---|---|---|---|---|---|---|---|---|
| | | d | | d | h | m | ° | ' |
| July | 1 | 20.55 | U | 1 | 05 | 37.9 | -3 | 34.7 |
| | 1 | | L | 1 | 17 | 58.9 | -0 | 50.3 |
| | 2 | 21.55 | U | 2 | 06 | 19.5 | +1 | 52.7 |
| | 2 | | L | 2 | 18 | 40.0 | 4 | 33.1 |
| | 3 | 22.55 | U | 3 | 07 | 00.4 | 7 | 09.5 |
| | 3 | | L | 3 | 19 | 21.0 | +9 | 40.8 |
| | 4 | 23.55 | U | 4 | 07 | 41.8 | 12 | 06.0 |
| | 4 | | L | 4 | 20 | 03.0 | 14 | 23.7 |
| | 5 | 24.55 | U | 5 | 08 | 24.6 | 16 | 32.7 |
| | 5 | | L | 5 | 20 | 46.7 | 18 | 31.5 |
| | 6 | 25.55 | U | 6 | 09 | 09.5 | +20 | 18.8 |
| | 6 | | L | 6 | 21 | 32.9 | 21 | 53.1 |
| | 7 | 26.55 | U | 7 | 09 | 56.9 | 23 | 12.7 |
| | 7 | | L | 7 | 22 | 21.5 | 24 | 16.2 |
| | 8 | 27.55 | U | 8 | 10 | 46.7 | 25 | 02.2 |
| | 8 | | L | 8 | 23 | 12.4 | +25 | 29.5 |
| | 9 | 28.55 | U | 9 | 11 | 38.4 | 25 | 37.0 |
| | 10 | 29.55 | L | 10 | 00 | 04.6 | 25 | 24.2 |
| | 10 | | U | 10 | 12 | 30.9 | 24 | 50.9 |
| | 11 | 0.95 | L | 11 | 00 | 57.0 | 23 | 57.4 |
| | 11 | | U | 11 | 13 | 23.0 | +22 | 44.1 |
| | 12 | 1.95 | L | 12 | 01 | 48.5 | 21 | 12.2 |
| | 12 | | U | 12 | 14 | 13.7 | 19 | 22.9 |
| | 13 | 2.95 | L | 13 | 02 | 38.4 | 17 | 17.7 |
| | 13 | | U | 13 | 15 | 02.8 | 14 | 58.3 |
| | 14 | 3.95 | L | 14 | 03 | 26.7 | +12 | 26.7 |
| | 14 | | U | 14 | 15 | 50.3 | 9 | 44.5 |
| | 15 | 4.95 | L | 15 | 04 | 13.7 | 6 | 53.8 |
| | 15 | | U | 15 | 16 | 37.0 | 3 | 56.5 |
| | 16 | 5.95 | L | 16 | 05 | 00.4 | +0 | 54.7 |
| | 16 | | U | 16 | 17 | 24.0 | -2 | 09.5 |
| | 17 | 6.95 | L | 17 | 05 | 47.9 | 5 | 13.8 |
| | 17 | | U | 17 | 18 | 12.3 | 8 | 15.9 |
| | 18 | 7.95 | L | 18 | 06 | 37.4 | 11 | 13.0 |
| | 18 | | U | 18 | 19 | 03.3 | 14 | 02.2 |
| | 19 | 8.95 | L | 19 | 07 | 30.1 | -16 | 40.5 |
| | 19 | | U | 19 | 19 | 57.9 | 19 | 04.5 |
| | 20 | 9.95 | L | 20 | 08 | 26.8 | 21 | 10.8 |
| | 20 | | U | 20 | 20 | 56.6 | 22 | 56.0 |
| | 21 | 10.95 | L | 21 | 09 | 27.4 | 24 | 16.8 |
| | 21 | | U | 21 | 21 | 58.7 | -25 | 10.9 |
| | 22 | 11.95 | L | 22 | 10 | 30.5 | 25 | 36.5 |
| | 22 | | U | 22 | 23 | 02.2 | 25 | 32.8 |
| | 23 | 12.95 | L | 23 | 11 | 33.5 | 25 | 00.5 |
| | 24 | 13.95 | U | 24 | 00 | 04.3 | -24 | 00.9 |
| | 24 | | L | 24 | 12 | 34.0 | -22 | 36.9 |
| | 25 | 14.95 | U | 25 | 01 | 02.6 | 20 | 51.3 |
| | 25 | | L | 25 | 13 | 30.0 | 18 | 47.6 |
| | 26 | 15.95 | U | 26 | 01 | 56.3 | 16 | 29.1 |
| | 26 | | L | 26 | 14 | 21.4 | 13 | 59.4 |
| | 27 | 16.95 | U | 27 | 02 | 45.5 | -11 | 21.2 |
| | 27 | | L | 27 | 15 | 08.6 | 8 | 37.5 |
| | 28 | 17.95 | U | 28 | 03 | 31.0 | 5 | 50.4 |
| | 28 | | L | 28 | 15 | 52.8 | 3 | 02.0 |
| | 29 | 18.95 | U | 29 | 04 | 14.1 | -0 | 14.1 |
| | 29 | | L | 29 | 16 | 35.1 | +2 | 31.7 |
| | 30 | 19.95 | U | 30 | 04 | 55.9 | 5 | 14.0 |
| | 30 | | L | 30 | 17 | 16.7 | 7 | 51.7 |
| | 31 | 20.95 | U | 31 | 05 | 37.6 | 10 | 23.4 |
| | 31 | | L | 31 | 17 | 58.7 | 12 | 48.1 |
| Aug. | 1 | 21.95 | U | 1 | 06 | 20.0 | +15 | 04.4 |
| | 1 | | L | 1 | 18 | 41.9 | 17 | 11.3 |
| | 2 | 22.95 | U | 2 | 07 | 04.2 | 19 | 07.3 |
| | 2 | | L | 2 | 19 | 27.1 | 20 | 51.1 |
| | 3 | 23.95 | U | 3 | 07 | 50.7 | 22 | 21.3 |
| | 3 | | L | 3 | 20 | 14.8 | +23 | 36.5 |
| | 4 | 24.95 | U | 4 | 08 | 39.6 | 24 | 35.1 |
| | 4 | | L | 4 | 21 | 04.9 | 25 | 15.9 |
| | 5 | 25.95 | U | 5 | 09 | 30.7 | 25 | 37.6 |
| | 5 | | L | 5 | 21 | 56.9 | 25 | 39.4 |
| | 6 | 26.95 | U | 6 | 10 | 23.3 | +25 | 20.5 |
| | 6 | | L | 6 | 22 | 49.7 | 24 | 40.7 |
| | 7 | 27.95 | U | 7 | 11 | 16.0 | 23 | 40.3 |
| | 7 | | L | 7 | 23 | 42.2 | 22 | 19.9 |
| | 8 | 28.95 | U | 8 | 12 | 08.0 | 20 | 40.5 |
| | 9 | 0.42 | L | 9 | 00 | 33.4 | +18 | 43.4 |
| | 9 | | U | 9 | 12 | 58.4 | 16 | 30.4 |
| | 10 | 1.42 | L | 10 | 01 | 23.0 | 14 | 03.3 |
| | 10 | | U | 10 | 13 | 47.3 | 11 | 24.2 |
| | 11 | 2.42 | L | 11 | 02 | 11.2 | 8 | 35.1 |
| | 11 | | U | 11 | 14 | 34.9 | +5 | 38.3 |
| | 12 | 3.42 | L | 12 | 02 | 58.5 | +2 | 36.1 |
| | 12 | | U | 12 | 15 | 22.1 | -0 | 29.3 |
| | 13 | 4.42 | L | 13 | 03 | 45.9 | 3 | 35.4 |
| | 13 | | U | 13 | 16 | 10.0 | 6 | 39.7 |
| | 14 | 5.42 | L | 14 | 04 | 34.6 | -9 | 39.8 |
| | 14 | | U | 14 | 16 | 59.8 | 12 | 32.9 |
| | 15 | 6.42 | L | 15 | 05 | 25.7 | 15 | 16.2 |
| | 15 | | U | 15 | 17 | 52.4 | 17 | 46.8 |
| | 16 | 7.42 | L | 16 | 06 | 20.0 | -20 | 01.8 |

**MOON, 2021**
AT EPHEMERIS TRANSIT

| Date | | Age (at $0^h$) | | Ephemeris Transit | | | Geocentric Declination | |
|---|---|---|---|---|---|---|---|---|
| | | d | | d | h | m | ° | ' |
| Aug. | 16 | | U | 16 | 18 | 48.5 | -21 | 58.1 |
| | 17 | 8.42 | L | 17 | 07 | 17.8 | 23 | 32.8 |
| | 17 | | U | 17 | 19 | 47.8 | 24 | 43.5 |
| | 18 | 9.42 | L | 18 | 08 | 18.4 | 25 | 28.2 |
| | 18 | | U | 18 | 20 | 49.2 | 25 | 45.5 |
| | 19 | 10.42 | L | 19 | 09 | 20.0 | -25 | 35.1 |
| | 19 | | U | 19 | 21 | 50.5 | 24 | 57.5 |
| | 20 | 11.42 | L | 20 | 10 | 20.3 | 23 | 54.2 |
| | 20 | | U | 20 | 22 | 49.4 | 22 | 27.2 |
| | 21 | 12.42 | L | 21 | 11 | 17.4 | 20 | 39.5 |
| | 21 | | U | 21 | 23 | 44.4 | -18 | 34.0 |
| | 22 | 13.42 | L | 22 | 12 | 10.3 | 16 | 13.8 |
| | 23 | 14.42 | U | 23 | 00 | 35.3 | 13 | 42.1 |
| | 23 | | L | 23 | 12 | 59.3 | 11 | 01.7 |
| | 24 | 15.42 | U | 24 | 01 | 22.5 | 8 | 15.4 |
| | 24 | | L | 24 | 13 | 45.0 | -5 | 25.6 |
| | 25 | 16.42 | U | 25 | 02 | 06.9 | -2 | 34.3 |
| | 25 | | L | 25 | 14 | 28.4 | +0 | 16.4 |
| | 26 | 17.42 | U | 26 | 02 | 49.7 | 3 | 04.8 |
| | 26 | | L | 26 | 15 | 10.8 | 5 | 49.4 |
| | 27 | 18.42 | U | 27 | 03 | 31.8 | +8 | 28.8 |
| | 27 | | L | 27 | 15 | 53.0 | 11 | 01.7 |
| | 28 | 19.42 | U | 28 | 04 | 14.3 | 13 | 26.7 |
| | 28 | | L | 28 | 16 | 36.0 | 15 | 42.7 |
| | 29 | 20.42 | U | 29 | 04 | 58.0 | 17 | 48.4 |
| | 29 | | L | 29 | 17 | 20.5 | +19 | 42.5 |
| | 30 | 21.42 | U | 30 | 05 | 43.6 | 21 | 23.8 |
| | 30 | | L | 30 | 18 | 07.2 | 22 | 50.8 |
| | 31 | 22.42 | U | 31 | 06 | 31.5 | 24 | 02.2 |
| | 31 | | L | 31 | 18 | 56.2 | 24 | 56.9 |
| Sept. | 1 | 23.42 | U | 1 | 07 | 21.5 | +25 | 33.4 |
| | 1 | | L | 1 | 19 | 47.3 | 25 | 50.8 |
| | 2 | 24.42 | U | 2 | 08 | 13.3 | 25 | 48.2 |
| | 2 | | L | 2 | 20 | 39.6 | 25 | 25.0 |
| | 3 | 25.42 | U | 3 | 09 | 05.9 | 24 | 40.9 |
| | 3 | | L | 3 | 21 | 32.2 | +23 | 36.2 |
| | 4 | 26.42 | U | 4 | 09 | 58.3 | 22 | 11.3 |
| | 4 | | L | 4 | 22 | 24.1 | 20 | 27.2 |
| | 5 | 27.42 | U | 5 | 10 | 49.7 | 18 | 25.1 |
| | 5 | | L | 5 | 23 | 14.9 | 16 | 06.6 |
| | 6 | 28.42 | U | 6 | 11 | 39.7 | +13 | 33.5 |
| | 7 | 29.42 | L | 7 | 00 | 04.3 | 10 | 47.8 |
| | 7 | | U | 7 | 12 | 28.6 | 7 | 51.9 |
| | 8 | 0.96 | L | 8 | 00 | 52.8 | 4 | 48.1 |
| | 8 | | U | 8 | 13 | 17.0 | +1 | 39.1 |

| Date | | Age (at $0^h$) | | Ephemeris Transit | | | Geocentric Declination | |
|---|---|---|---|---|---|---|---|---|
| | | d | | d | h | m | ° | ' |
| Sept. | 9 | 1.96 | L | 9 | 01 | 41.3 | -1 | 32.6 |
| | 9 | | U | 9 | 14 | 05.8 | 4 | 44.2 |
| | 10 | 2.96 | L | 10 | 02 | 30.6 | 7 | 52.8 |
| | 10 | | U | 10 | 14 | 55.9 | 10 | 55.4 |
| | 11 | 3.96 | L | 11 | 03 | 21.8 | 13 | 49.1 |
| | 11 | | U | 11 | 15 | 48.4 | -16 | 30.8 |
| | 12 | 4.96 | L | 12 | 04 | 15.8 | 18 | 57.5 |
| | 12 | | U | 12 | 16 | 43.9 | 21 | 06.1 |
| | 13 | 5.96 | L | 13 | 05 | 12.8 | 22 | 54.1 |
| | 13 | | U | 13 | 17 | 42.3 | 24 | 18.9 |
| | 14 | 6.96 | L | 14 | 06 | 12.3 | -25 | 18.5 |
| | 14 | | U | 14 | 18 | 42.6 | 25 | 51.7 |
| | 15 | 7.96 | L | 15 | 07 | 12.9 | 25 | 57.8 |
| | 15 | | U | 15 | 19 | 43.0 | 25 | 37.1 |
| | 16 | 8.96 | L | 16 | 08 | 12.6 | 24 | 50.6 |
| | 16 | | U | 16 | 20 | 41.5 | -23 | 40.0 |
| | 17 | 9.96 | L | 17 | 09 | 09.6 | 22 | 07.5 |
| | 17 | | U | 17 | 21 | 36.7 | 20 | 15.8 |
| | 18 | 10.96 | L | 18 | 10 | 02.8 | 18 | 07.6 |
| | 18 | | U | 18 | 22 | 28.0 | 15 | 45.8 |
| | 19 | 11.96 | L | 19 | 10 | 52.3 | -13 | 13.0 |
| | 19 | | U | 19 | 23 | 15.7 | 10 | 31.9 |
| | 20 | 12.96 | L | 20 | 11 | 38.5 | 7 | 45.0 |
| | 21 | 13.96 | U | 21 | 00 | 00.7 | 4 | 54.4 |
| | 21 | | L | 21 | 12 | 22.4 | -2 | 02.4 |
| | 22 | 14.96 | U | 22 | 00 | 43.8 | +0 | 49.3 |
| | 22 | | L | 22 | 13 | 05.0 | 3 | 38.8 |
| | 23 | 15.96 | U | 23 | 01 | 26.1 | 6 | 24.5 |
| | 23 | | L | 23 | 13 | 47.3 | 9 | 04.8 |
| | 24 | 16.96 | U | 24 | 02 | 08.6 | 11 | 38.4 |
| | 24 | | L | 24 | 14 | 30.1 | +14 | 03.7 |
| | 25 | 17.96 | U | 25 | 02 | 52.0 | 16 | 19.5 |
| | 25 | | L | 25 | 15 | 14.2 | 18 | 24.4 |
| | 26 | 18.96 | U | 26 | 03 | 36.9 | 20 | 17.1 |
| | 26 | | L | 26 | 16 | 00.2 | 21 | 56.2 |
| | 27 | 19.96 | U | 27 | 04 | 23.9 | +23 | 20.5 |
| | 27 | | L | 27 | 16 | 48.2 | 24 | 28.8 |
| | 28 | 20.96 | U | 28 | 05 | 12.9 | 25 | 19.8 |
| | 28 | | L | 28 | 17 | 38.1 | 25 | 52.6 |
| | 29 | 21.96 | U | 29 | 06 | 03.6 | 26 | 06.2 |
| | 29 | | L | 29 | 18 | 29.3 | +26 | 00.1 |
| | 30 | 22.96 | U | 30 | 06 | 55.2 | 25 | 33.7 |
| | 30 | | L | 30 | 19 | 21.2 | 24 | 47.0 |
| Oct. | 1 | 23.96 | U | 1 | 07 | 47.0 | 23 | 40.1 |
| | 1 | | L | 1 | 20 | 12.7 | +22 | 13.6 |

**MOON, 2021**
AT EPHEMERIS TRANSIT

| Date | | Age (at $0^h$) | | Ephemeris Transit | | | Geocentric Declination | |
|---|---|---|---|---|---|---|---|---|
| | | d | | d | h | m | ° | ' |
| Oct. | 2 | 24.96 | U | 2 | 08 | 38.2 | +20 | 28.1 |
| | 2 | | L | 2 | 21 | 03.4 | 18 | 24.7 |
| | 3 | 25.96 | U | 3 | 09 | 28.4 | 16 | 04.8 |
| | 3 | | L | 3 | 21 | 53.1 | 13 | 30.0 |
| | 4 | 26.96 | U | 4 | 10 | 17.7 | 10 | 42.1 |
| | 4 | | L | 4 | 22 | 42.1 | +7 | 43.1 |
| | 5 | 27.96 | U | 5 | 11 | 06.6 | 4 | 35.5 |
| | 5 | | L | 5 | 23 | 31.1 | +1 | 21.6 |
| | 6 | 28.96 | U | 6 | 11 | 55.8 | -1 | 55.5 |
| | 7 | 0.54 | L | 7 | 00 | 20.9 | 5 | 13.0 |
| | 7 | | U | 7 | 12 | 46.5 | -8 | 27.5 |
| | 8 | 1.54 | L | 8 | 01 | 12.7 | 11 | 35.7 |
| | 8 | | U | 8 | 13 | 39.6 | 14 | 33.9 |
| | 9 | 2.54 | L | 9 | 02 | 07.3 | 17 | 18.6 |
| | 9 | | U | 9 | 14 | 35.8 | 19 | 46.3 |
| | 10 | 3.54 | L | 10 | 03 | 05.0 | -21 | 53.8 |
| | 10 | | U | 10 | 15 | 35.0 | 23 | 37.9 |
| | 11 | 4.54 | L | 11 | 04 | 05.5 | 24 | 56.4 |
| | 11 | | U | 11 | 16 | 36.3 | 25 | 47.6 |
| | 12 | 5.54 | L | 12 | 05 | 07.1 | 26 | 10.7 |
| | 12 | | U | 12 | 17 | 37.7 | -26 | 05.9 |
| | 13 | 6.54 | L | 13 | 06 | 07.8 | 25 | 34.1 |
| | 13 | | U | 13 | 18 | 37.2 | 24 | 37.1 |
| | 14 | 7.54 | L | 14 | 07 | 05.6 | 23 | 17.1 |
| | 14 | | U | 14 | 19 | 33.0 | 21 | 36.9 |
| | 15 | 8.54 | L | 15 | 07 | 59.4 | -19 | 39.0 |
| | 15 | | U | 15 | 20 | 24.8 | 17 | 26.4 |
| | 16 | 9.54 | L | 16 | 08 | 49.2 | 15 | 01.6 |
| | 16 | | U | 16 | 21 | 12.7 | 12 | 27.2 |
| | 17 | 10.54 | L | 17 | 09 | 35.5 | 9 | 45.6 |
| | 17 | | U | 17 | 21 | 57.6 | -6 | 58.9 |
| | 18 | 11.54 | L | 18 | 10 | 19.3 | 4 | 09.0 |
| | 18 | | U | 18 | 22 | 40.6 | -1 | 17.9 |
| | 19 | 12.54 | L | 19 | 11 | 01.6 | +1 | 32.7 |
| | 19 | | U | 19 | 23 | 22.6 | 4 | 21.1 |
| | 20 | 13.54 | L | 20 | 11 | 43.5 | +7 | 05.8 |
| | 21 | 14.54 | U | 21 | 00 | 04.6 | 9 | 45.1 |
| | 21 | | L | 21 | 12 | 25.9 | 12 | 17.6 |
| | 22 | 15.54 | U | 22 | 00 | 47.4 | 14 | 41.9 |
| | 22 | | L | 22 | 13 | 09.4 | 16 | 56.3 |
| | 23 | 16.54 | U | 23 | 01 | 31.8 | +18 | 59.6 |
| | 23 | | L | 23 | 13 | 54.7 | 20 | 50.1 |
| | 24 | 17.54 | U | 24 | 02 | 18.0 | 22 | 26.7 |
| | 24 | | L | 24 | 14 | 41.9 | 23 | 47.9 |
| | 25 | 18.54 | U | 25 | 03 | 06.3 | +24 | 52.5 |

| Date | | Age (at $0^h$) | | Ephemeris Transit | | | Geocentric Declination | |
|---|---|---|---|---|---|---|---|---|
| | | d | | d | h | m | ° | ' |
| Oct. | 25 | | L | 25 | 15 | 31.1 | +25 | 39.6 |
| | 26 | 19.54 | U | 26 | 03 | 56.2 | 26 | 08.1 |
| | 26 | | L | 26 | 16 | 21.5 | 26 | 17.5 |
| | 27 | 20.54 | U | 27 | 04 | 47.0 | 26 | 07.2 |
| | 27 | | L | 27 | 17 | 12.5 | 25 | 37.2 |
| | 28 | 21.54 | U | 28 | 05 | 38.0 | +24 | 47.6 |
| | 28 | | L | 28 | 18 | 03.3 | 23 | 38.6 |
| | 29 | 22.54 | U | 29 | 06 | 28.3 | 22 | 11.0 |
| | 29 | | L | 29 | 18 | 53.1 | 20 | 25.5 |
| | 30 | 23.54 | U | 30 | 07 | 17.7 | 18 | 23.0 |
| | 30 | | L | 30 | 19 | 41.9 | +16 | 04.8 |
| | 31 | 24.54 | U | 31 | 08 | 06.0 | 13 | 32.3 |
| | 31 | | L | 31 | 20 | 30.0 | 10 | 46.8 |
| Nov. | 1 | 25.54 | U | 1 | 08 | 53.9 | 7 | 50.2 |
| | 1 | | L | 1 | 21 | 17.9 | 4 | 44.3 |
| | 2 | 26.54 | U | 2 | 09 | 42.2 | +1 | 31.5 |
| | 2 | | L | 2 | 22 | 06.8 | -1 | 45.8 |
| | 3 | 27.54 | U | 3 | 10 | 31.9 | 5 | 04.7 |
| | 3 | | L | 3 | 22 | 57.6 | 8 | 22.0 |
| | 4 | 28.54 | U | 4 | 11 | 24.2 | 11 | 34.0 |
| | 4 | | L | 4 | 23 | 51.6 | -14 | 36.9 |
| | 5 | 0.11 | U | 5 | 12 | 20.0 | 17 | 26.5 |
| | 6 | 1.11 | L | 6 | 00 | 49.5 | 19 | 58.8 |
| | 6 | | U | 6 | 13 | 19.8 | 22 | 09.6 |
| | 7 | 2.11 | L | 7 | 01 | 51.0 | 23 | 55.5 |
| | 7 | | U | 7 | 14 | 22.8 | -25 | 13.4 |
| | 8 | 3.11 | L | 8 | 02 | 54.8 | 26 | 01.7 |
| | 8 | | U | 8 | 15 | 26.9 | 26 | 19.6 |
| | 9 | 4.11 | L | 9 | 03 | 58.5 | 26 | 07.5 |
| | 9 | | U | 9 | 16 | 29.4 | 25 | 27.1 |
| | 10 | 5.11 | L | 10 | 04 | 59.3 | -24 | 20.7 |
| | 10 | | U | 10 | 17 | 28.2 | 22 | 51.4 |
| | 11 | 6.11 | L | 11 | 05 | 55.7 | 21 | 02.3 |
| | 11 | | U | 11 | 18 | 22.1 | 18 | 56.8 |
| | 12 | 7.11 | L | 12 | 06 | 47.2 | 16 | 37.8 |
| | 12 | | U | 12 | 19 | 11.3 | -14 | 08.2 |
| | 13 | 8.11 | L | 13 | 07 | 34.5 | 11 | 30.4 |
| | 13 | | U | 13 | 19 | 56.9 | 8 | 46.8 |
| | 14 | 9.11 | L | 14 | 08 | 18.7 | 5 | 59.4 |
| | 14 | | U | 14 | 20 | 39.9 | 3 | 09.9 |
| | 15 | 10.11 | L | 15 | 09 | 00.9 | -0 | 20.0 |
| | 15 | | U | 15 | 21 | 21.6 | +2 | 28.7 |
| | 16 | 11.11 | L | 16 | 09 | 42.3 | 5 | 14.8 |
| | 16 | | U | 16 | 22 | 03.0 | 7 | 56.9 |
| | 17 | 12.11 | L | 17 | 10 | 23.9 | +10 | 33.4 |

**MOON, 2021**
AT EPHEMERIS TRANSIT

| Date | | Age ( at $0^h$ ) | | Ephemeris Transit | | | Geocentric Declination | |
|---|---|---|---|---|---|---|---|---|
| | | d | | d | h | m | ° | ' |
| Nov. | 17 | | U | 17 | 22 | 45.1 | +13 | 02.9 |
| | 18 | 13.11 | L | 18 | 11 | 06.6 | 15 | 24.1 |
| | 18 | | U | 18 | 23 | 28.6 | 17 | 35.3 |
| | 19 | 14.11 | L | 19 | 11 | 51.1 | 19 | 35.1 |
| | 20 | 15.11 | U | 20 | 00 | 14.1 | 21 | 22.0 |
| | 20 | | L | 20 | 12 | 37.7 | +22 | 54.6 |
| | 21 | 16.11 | U | 21 | 01 | 01.7 | 24 | 11.4 |
| | 21 | | L | 21 | 13 | 26.3 | 25 | 11.2 |
| | 22 | 17.11 | U | 22 | 01 | 51.2 | 25 | 53.0 |
| | 22 | | L | 22 | 14 | 16.4 | 26 | 15.9 |
| | 23 | 18.11 | U | 23 | 02 | 41.7 | +26 | 19.5 |
| | 23 | | L | 23 | 15 | 07.1 | 26 | 03.6 |
| | 24 | 19.11 | U | 24 | 03 | 32.4 | 25 | 28.1 |
| | 24 | | L | 24 | 15 | 57.5 | 24 | 33.5 |
| | 25 | 20.11 | U | 25 | 04 | 22.4 | 23 | 20.4 |
| | 25 | | L | 25 | 16 | 46.9 | +21 | 49.7 |
| | 26 | 21.11 | U | 26 | 05 | 11.1 | 20 | 02.3 |
| | 26 | | L | 26 | 17 | 34.9 | 17 | 59.5 |
| | 27 | 22.11 | U | 27 | 05 | 58.4 | 15 | 42.3 |
| | 27 | | L | 27 | 18 | 21.6 | 13 | 12.1 |
| | 28 | 23.11 | U | 28 | 06 | 44.7 | +10 | 30.4 |
| | 28 | | L | 28 | 19 | 07.8 | 7 | 38.5 |
| | 29 | 24.11 | U | 29 | 07 | 31.0 | 4 | 38.0 |
| | 29 | | L | 29 | 19 | 54.4 | +1 | 30.9 |
| | 30 | 25.11 | U | 30 | 08 | 18.2 | -1 | 40.8 |
| | 30 | | L | 30 | 20 | 42.6 | -4 | 54.7 |
| Dec. | 1 | 26.11 | U | 1 | 09 | 07.7 | 8 | 08.0 |
| | 1 | | L | 1 | 21 | 33.7 | 11 | 17.6 |
| | 2 | 27.11 | U | 2 | 10 | 00.7 | 14 | 19.6 |
| | 2 | | L | 2 | 22 | 28.9 | 17 | 10.2 |
| | 3 | 28.11 | U | 3 | 10 | 58.3 | -19 | 44.9 |
| | 3 | | L | 3 | 23 | 28.9 | 21 | 59.3 |
| | 4 | 29.11 | U | 4 | 12 | 00.5 | 23 | 49.0 |
| | 5 | 0.68 | L | 5 | 00 | 33.1 | 25 | 10.7 |
| | 5 | | U | 5 | 13 | 06.1 | 26 | 01.3 |
| | 6 | 1.68 | L | 6 | 01 | 39.2 | -26 | 19.8 |
| | 6 | | U | 6 | 14 | 12.1 | 26 | 06.2 |
| | 7 | 2.68 | L | 7 | 02 | 44.2 | 25 | 22.1 |
| | 7 | | U | 7 | 15 | 15.3 | 24 | 10.3 |
| | 8 | 3.68 | L | 8 | 03 | 45.1 | 22 | 34.0 |
| | 8 | | U | 8 | 16 | 13.6 | -20 | 37.3 |
| | 9 | 4.68 | L | 9 | 04 | 40.6 | 18 | 23.9 |
| | 9 | | U | 9 | 17 | 06.3 | 15 | 57.5 |
| | 10 | 5.68 | L | 10 | 05 | 30.8 | 13 | 21.2 |
| | 10 | | U | 10 | 17 | 54.3 | -10 | 37.8 |

| Date | | Age ( at $0^h$ ) | | Ephemeris Transit | | | Geocentric Declination | |
|---|---|---|---|---|---|---|---|---|
| | | d | | d | h | m | ° | ' |
| Dec. | 11 | 6.68 | L | 11 | 06 | 16.9 | -7 | 49.8 |
| | 11 | | U | 11 | 18 | 38.7 | 4 | 59.2 |
| | 12 | 7.68 | L | 12 | 07 | 00.1 | -2 | 07.9 |
| | 12 | | U | 12 | 19 | 21.0 | +0 | 42.5 |
| | 13 | 8.68 | L | 13 | 07 | 41.7 | 3 | 30.7 |
| | 13 | | U | 13 | 20 | 02.4 | +6 | 15.2 |
| | 14 | 9.68 | L | 14 | 08 | 23.1 | 8 | 54.8 |
| | 14 | | U | 14 | 20 | 44.0 | 11 | 28.2 |
| | 15 | 10.68 | L | 15 | 09 | 05.1 | 13 | 54.0 |
| | 15 | | U | 15 | 21 | 26.7 | 16 | 11.0 |
| | 16 | 11.68 | L | 16 | 09 | 48.8 | +18 | 17.6 |
| | 16 | | U | 16 | 22 | 11.3 | 20 | 12.6 |
| | 17 | 12.68 | L | 17 | 10 | 34.5 | 21 | 54.3 |
| | 17 | | U | 17 | 22 | 58.2 | 23 | 21.3 |
| | 18 | 13.68 | L | 18 | 11 | 22.4 | 24 | 32.3 |
| | 18 | | U | 18 | 23 | 47.1 | +25 | 26.0 |
| | 19 | 14.68 | L | 19 | 12 | 12.2 | 26 | 01.2 |
| | 20 | 15.68 | U | 20 | 00 | 37.6 | 26 | 17.3 |
| | 20 | | L | 20 | 13 | 03.1 | 26 | 13.7 |
| | 21 | 16.68 | U | 21 | 01 | 28.6 | 25 | 50.4 |
| | 21 | | L | 21 | 13 | 53.9 | +25 | 07.5 |
| | 22 | 17.68 | U | 22 | 02 | 19.0 | 24 | 05.7 |
| | 22 | | L | 22 | 14 | 43.7 | 22 | 45.9 |
| | 23 | 18.68 | U | 23 | 03 | 08.0 | 21 | 09.1 |
| | 23 | | L | 23 | 15 | 31.8 | 19 | 16.6 |
| | 24 | 19.68 | U | 24 | 03 | 55.2 | +17 | 09.8 |
| | 24 | | L | 24 | 16 | 18.3 | 14 | 50.0 |
| | 25 | 20.68 | U | 25 | 04 | 41.0 | 12 | 18.8 |
| | 25 | | L | 25 | 17 | 03.5 | 9 | 37.6 |
| | 26 | 21.68 | U | 26 | 05 | 25.9 | 6 | 47.9 |
| | 26 | | L | 26 | 17 | 48.3 | +3 | 51.3 |
| | 27 | 22.68 | U | 27 | 06 | 10.9 | +0 | 49.4 |
| | 27 | | L | 27 | 18 | 33.9 | -2 | 15.8 |
| | 28 | 23.68 | U | 28 | 06 | 57.4 | 5 | 22.3 |
| | 28 | | L | 28 | 19 | 21.5 | 8 | 27.8 |
| | 29 | 24.68 | U | 29 | 07 | 46.5 | -11 | 29.6 |
| | 29 | | L | 29 | 20 | 12.6 | 14 | 24.6 |
| | 30 | 25.68 | U | 30 | 08 | 39.8 | 17 | 09.2 |
| | 30 | | L | 30 | 21 | 08.3 | 19 | 39.7 |
| | 31 | 26.68 | U | 31 | 09 | 38.1 | 21 | 51.6 |
| | 31 | | L | 31 | 22 | 09.1 | -23 | 41.1 |
| | 32 | 27.68 | U | 1 | 10 | 41.2 | 25 | 03.7 |
| | 32 | | L | 1 | 23 | 14.1 | 25 | 56.8 |
| | 33 | 28.68 | U | 2 | 11 | 47.4 | 26 | 17.8 |
| | 34 | 0.23 | L | 3 | 00 | 20.6 | -26 | 06.3 |

**MOON, 2021**
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR $0^h$ TERRESTRIAL TIME

| Date $0^h$ TT | | The Earth's Selenographic Long. | The Earth's Selenographic Lat. | The Sun's Selenographic Colong. | The Sun's Selenographic Lat. | Position Angle of Axis | Position Angle of Bright Limb | Fraction Illuminated |
|---|---|---|---|---|---|---|---|---|
| | | ° | ° | ° | ° | ° | ° | |
| Jan. | 0 | -4.997 | -3.368 | 104.92 | -0.51 | 10 | 84 | 0.992 |
| | 1 | 5.232 | 4.599 | 117.05 | 0.55 | 15 | 95 | 0.963 |
| | 2 | 5.220 | 5.607 | 129.18 | 0.58 | 19 | 101 | 0.913 |
| | 3 | 4.975 | 6.323 | 141.31 | 0.61 | 21 | 106 | 0.844 |
| | 4 | 4.517 | 6.695 | 153.45 | 0.64 | 23 | 110 | 0.757 |
| | 5 | 3.871 | 6.685 | 165.60 | 0.67 | 23 | 112 | 0.656 |
| | 6 | -3.064 | -6.280 | 177.75 | -0.71 | 22 | 113 | 0.547 |
| | 7 | 2.124 | 5.492 | 189.91 | 0.74 | 20 | 112 | 0.433 |
| | 8 | -1.078 | 4.360 | 202.07 | 0.77 | 17 | 110 | 0.322 |
| | 9 | +0.038 | 2.946 | 214.24 | 0.80 | 13 | 106 | 0.219 |
| | 10 | 1.185 | -1.342 | 226.42 | 0.83 | 8 | 101 | 0.131 |
| | 11 | 2.311 | +0.346 | 238.61 | 0.86 | 2 | 93 | 0.063 |
| | 12 | +3.353 | +2.004 | 250.79 | -0.89 | 356 | 82 | 0.019 |
| | 13 | 4.243 | 3.520 | 262.98 | 0.92 | 350 | 37 | 0.001 |
| | 14 | 4.910 | 4.803 | 275.17 | 0.94 | 345 | 276 | 0.009 |
| | 15 | 5.296 | 5.786 | 287.36 | 0.97 | 341 | 262 | 0.040 |
| | 16 | 5.359 | 6.434 | 299.55 | 0.99 | 338 | 256 | 0.092 |
| | 17 | 5.083 | 6.738 | 311.73 | 1.01 | 337 | 252 | 0.159 |
| | 18 | +4.479 | +6.709 | 323.91 | -1.02 | 337 | 250 | 0.239 |
| | 19 | 3.583 | 6.372 | 336.09 | 1.04 | 337 | 249 | 0.326 |
| | 20 | 2.455 | 5.760 | 348.25 | 1.05 | 339 | 249 | 0.419 |
| | 21 | +1.167 | 4.908 | 0.42 | 1.06 | 341 | 250 | 0.513 |
| | 22 | -0.195 | 3.852 | 12.57 | 1.08 | 344 | 252 | 0.606 |
| | 23 | -1.543 | 2.631 | 24.72 | 1.09 | 348 | 256 | 0.696 |
| | 24 | -2.789 | +1.287 | 36.87 | -1.10 | 352 | 260 | 0.780 |
| | 25 | 3.852 | -0.132 | 49.01 | 1.12 | 357 | 266 | 0.854 |
| | 26 | 4.662 | 1.570 | 61.15 | 1.13 | 3 | 273 | 0.917 |
| | 27 | 5.165 | 2.960 | 73.28 | 1.15 | 8 | 282 | 0.964 |
| | 28 | 5.332 | 4.227 | 85.41 | 1.17 | 13 | 300 | 0.992 |
| | 29 | 5.165 | 5.292 | 97.54 | 1.19 | 17 | 47 | 0.998 |
| | 30 | -4.691 | -6.078 | 109.67 | -1.20 | 21 | 93 | 0.981 |
| | 31 | 3.968 | 6.520 | 121.80 | 1.22 | 23 | 103 | 0.940 |
| Feb. | 1 | 3.069 | 6.575 | 133.93 | 1.24 | 23 | 108 | 0.877 |
| | 2 | 2.073 | 6.228 | 146.07 | 1.26 | 23 | 110 | 0.793 |
| | 3 | 1.052 | 5.497 | 158.22 | 1.28 | 21 | 110 | 0.694 |
| | 4 | -0.059 | 4.428 | 170.37 | 1.30 | 18 | 109 | 0.585 |
| | 5 | +0.871 | -3.088 | 182.53 | -1.32 | 14 | 106 | 0.471 |
| | 6 | 1.725 | -1.566 | 194.69 | 1.34 | 9 | 101 | 0.359 |
| | 7 | 2.495 | +0.044 | 206.87 | 1.36 | 4 | 95 | 0.255 |
| | 8 | 3.178 | 1.643 | 219.05 | 1.38 | 358 | 88 | 0.164 |
| | 9 | 3.760 | 3.132 | 231.24 | 1.40 | 352 | 80 | 0.091 |
| | 10 | 4.219 | 4.426 | 243.43 | 1.42 | 347 | 70 | 0.038 |
| | 11 | +4.519 | +5.456 | 255.62 | -1.44 | 342 | 51 | 0.009 |
| | 12 | 4.617 | 6.174 | 267.82 | 1.45 | 339 | 312 | 0.002 |
| | 13 | 4.477 | 6.556 | 280.02 | 1.47 | 337 | 266 | 0.018 |
| | 14 | 4.072 | 6.603 | 292.21 | 1.48 | 337 | 257 | 0.053 |
| | 15 | +3.393 | +6.333 | 304.41 | -1.48 | 337 | 253 | 0.106 |

**MOON, 2021**
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR $0^h$ TERRESTRIAL TIME

| Date $0^h$ TT | | The Earth's Selenographic | | The Sun's Selenographic | | Position Angle of | | Fraction Illuminated |
|---|---|---|---|---|---|---|---|---|
| | | Long. | Lat. | Colong. | Lat. | Axis | Bright Limb | |
| | | ° | ° | ° | ° | ° | ° | |
| Feb. | 15 | +3.393 | +6.333 | 304.41 | -1.48 | 337 | 253 | 0.106 |
| | 16 | 2.458 | 5.777 | 316.59 | 1.49 | 338 | 251 | 0.173 |
| | 17 | +1.307 | 4.973 | 328.78 | 1.50 | 340 | 252 | 0.251 |
| | 18 | -0.001 | 3.964 | 340.96 | 1.50 | 343 | 253 | 0.336 |
| | 19 | 1.388 | 2.790 | 353.14 | 1.50 | 347 | 256 | 0.428 |
| | 20 | 2.763 | 1.496 | 5.31 | 1.50 | 351 | 259 | 0.522 |
| | 21 | -4.030 | +0.127 | 17.47 | -1.50 | 356 | 264 | 0.616 |
| | 22 | 5.093 | -1.269 | 29.63 | 1.50 | 1 | 270 | 0.708 |
| | 23 | 5.861 | 2.633 | 41.78 | 1.50 | 6 | 276 | 0.794 |
| | 24 | 6.259 | 3.902 | 53.93 | 1.50 | 11 | 283 | 0.870 |
| | 25 | 6.240 | 5.000 | 66.07 | 1.51 | 16 | 291 | 0.932 |
| | 26 | 5.791 | 5.848 | 78.21 | 1.51 | 20 | 303 | 0.975 |
| | 27 | -4.944 | -6.370 | 90.35 | -1.51 | 22 | 339 | 0.997 |
| | 28 | 3.777 | 6.506 | 102.49 | 1.51 | 23 | 84 | 0.992 |
| Mar. | 1 | 2.404 | 6.225 | 114.63 | 1.51 | 23 | 102 | 0.961 |
| | 2 | -0.954 | 5.536 | 126.77 | 1.51 | 22 | 106 | 0.905 |
| | 3 | +0.452 | 4.484 | 138.92 | 1.51 | 19 | 107 | 0.825 |
| | 4 | 1.718 | 3.148 | 151.07 | 1.51 | 15 | 105 | 0.729 |
| | 5 | +2.785 | -1.628 | 163.23 | -1.52 | 10 | 102 | 0.621 |
| | 6 | 3.633 | -0.026 | 175.40 | 1.52 | 5 | 96 | 0.508 |
| | 7 | 4.264 | +1.555 | 187.58 | 1.53 | 359 | 90 | 0.397 |
| | 8 | 4.695 | 3.026 | 199.76 | 1.53 | 353 | 84 | 0.293 |
| | 9 | 4.946 | 4.307 | 211.95 | 1.54 | 348 | 77 | 0.200 |
| | 10 | 5.028 | 5.338 | 224.15 | 1.55 | 343 | 70 | 0.122 |
| | 11 | +4.943 | +6.074 | 236.35 | -1.55 | 340 | 62 | 0.063 |
| | 12 | 4.683 | 6.490 | 248.56 | 1.56 | 338 | 52 | 0.023 |
| | 13 | 4.233 | 6.578 | 260.77 | 1.56 | 337 | 22 | 0.004 |
| | 14 | 3.580 | 6.348 | 272.98 | 1.56 | 337 | 283 | 0.005 |
| | 15 | 2.720 | 5.826 | 285.19 | 1.56 | 338 | 261 | 0.025 |
| | 16 | 1.661 | 5.048 | 297.40 | 1.55 | 340 | 256 | 0.064 |
| | 17 | +0.431 | +4.057 | 309.60 | -1.55 | 342 | 255 | 0.117 |
| | 18 | -0.925 | 2.898 | 321.80 | 1.54 | 345 | 256 | 0.184 |
| | 19 | 2.343 | 1.620 | 334.00 | 1.53 | 349 | 259 | 0.262 |
| | 20 | 3.745 | +0.270 | 346.20 | 1.52 | 354 | 262 | 0.349 |
| | 21 | 5.041 | -1.103 | 358.38 | 1.51 | 359 | 267 | 0.442 |
| | 22 | 6.135 | -2.449 | 10.57 | 1.49 | 4 | 273 | 0.539 |
| | 23 | -6.929 | -3.710 | 22.74 | -1.48 | 9 | 279 | 0.637 |
| | 24 | 7.337 | 4.822 | 34.92 | 1.46 | 14 | 285 | 0.732 |
| | 25 | 7.292 | 5.717 | 47.08 | 1.45 | 18 | 291 | 0.820 |
| | 26 | 6.760 | 6.318 | 59.24 | 1.43 | 21 | 297 | 0.895 |
| | 27 | 5.755 | 6.557 | 71.40 | 1.42 | 23 | 304 | 0.954 |
| | 28 | 4.346 | 6.382 | 83.55 | 1.40 | 23 | 318 | 0.989 |
| | 29 | -2.652 | -5.776 | 95.70 | -1.38 | 22 | 57 | 0.998 |
| | 30 | -0.826 | 4.767 | 107.86 | 1.36 | 20 | 99 | 0.977 |
| | 31 | +0.972 | 3.426 | 120.02 | 1.35 | 17 | 103 | 0.928 |
| Apr. | 1 | 2.605 | 1.860 | 132.18 | 1.33 | 12 | 102 | 0.855 |
| | 2 | 3.976 | -0.193 | 144.34 | -1.32 | 7 | 98 | 0.763 |

**MOON, 2021**
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR $0^h$ TERRESTRIAL TIME

| Date $0^h$ TT | The Earth's Selenographic | | The Sun's Selenographic | | Position Angle of | | Fraction Illuminated |
|---|---|---|---|---|---|---|---|
| | Long. | Lat. | Colong. | Lat. | Axis | Bright Limb | |
| | ° | ° | ° | ° | ° | ° | |
| Apr. 1 | +2.605 | -1.860 | 132.18 | -1.33 | 12 | 102 | 0.855 |
| 2 | 3.976 | -0.193 | 144.34 | 1.32 | 7 | 98 | 0.763 |
| 3 | 5.031 | +1.456 | 156.52 | 1.30 | 1 | 92 | 0.658 |
| 4 | 5.758 | 2.982 | 168.70 | 1.29 | 355 | 86 | 0.548 |
| 5 | 6.170 | 4.305 | 180.89 | 1.28 | 349 | 80 | 0.438 |
| 6 | 6.296 | 5.365 | 193.09 | 1.28 | 344 | 74 | 0.334 |
| 7 | +6.166 | +6.125 | 205.29 | -1.27 | 341 | 69 | 0.239 |
| 8 | 5.811 | 6.563 | 217.50 | 1.26 | 338 | 64 | 0.158 |
| 9 | 5.252 | 6.677 | 229.72 | 1.26 | 337 | 60 | 0.092 |
| 10 | 4.508 | 6.474 | 241.94 | 1.25 | 337 | 55 | 0.043 |
| 11 | 3.590 | 5.977 | 254.16 | 1.24 | 338 | 47 | 0.013 |
| 12 | 2.514 | 5.217 | 266.38 | 1.23 | 339 | 355 | 0.001 |
| 13 | +1.298 | +4.234 | 278.61 | -1.22 | 341 | 268 | 0.008 |
| 14 | -0.032 | 3.075 | 290.84 | 1.20 | 345 | 259 | 0.033 |
| 15 | 1.438 | 1.789 | 303.06 | 1.19 | 348 | 259 | 0.074 |
| 16 | 2.869 | +0.428 | 315.28 | 1.17 | 353 | 261 | 0.131 |
| 17 | 4.264 | -0.957 | 327.50 | 1.15 | 357 | 265 | 0.201 |
| 18 | | | | | | | |
| | -5.548 | -2.313 | 339.71 | -1.13 | 2 | 270 | 0.283 |
| 19 | 6.640 | 3.5860 | 351.92 | 1.10 | 8 | 276 | 0.374 |
| 20 | 7.454 | 4.7190 | 4.12 | 1.08 | 12 | 281 | 0.472 |
| 21 | 7.907 | 5.6520 | 16.32 | 1.05 | 17 | 286 | 0.574 |
| 22 | 7.927 | 6.3220 | 28.51 | 1.03 | 20 | 291 | 0.676 |
| 23 | 7.469 | 6.6630 | 40.70 | 1.00 | 22 | 295 | 0.773 |
| 24 | 6.523 | 6.6200 | 52.87 | 0.97 | 23 | 299 | 0.860 |
| 25 | -5.131 | -6.154 | 65.05 | -0.94 | 23 | 301 | 0.931 |
| 26 | 3.385 | 5.2640 | 77.22 | 0.91 | 21 | 306 | 0.979 |
| 27 | -1.422 | 3.9910 | 89.39 | 0.88 | 18 | 345 | 0.999 |
| 28 | +0.595 | 2.4260 | 101.56 | 0.84 | 14 | 97 | 0.989 |
| 29 | 2.507 | -0.694 | 113.73 | 0.82 | 9 | 99 | 0.948 |
| 30 | 4.180 | +1.063 | 125.91 | 0.79 | 3 | 95 | 0.882 |
| May 1 | +5.521 | +2.715 | 138.09 | -0.76 | 357 | 90 | 0.796 |
| 2 | 6.479 | 4.158 | 150.27 | 0.74 | 351 | 83 | 0.696 |
| 3 | 7.041 | 5.319 | 162.47 | 0.72 | 346 | 77 | 0.590 |
| 4 | 7.222 | 6.157 | 174.67 | 0.70 | 342 | 72 | 0.483 |
| 5 | 7.055 | 6.655 | 186.88 | 0.68 | 339 | 68 | 0.380 |
| 6 | 6.583 | 6.815 | 199.10 | 0.67 | 337 | 65 | 0.284 |
| 7 | +5.853 | +6.651 | 211.32 | -0.65 | 337 | 63 | 0.199 |
| 8 | 4.908 | 6.187 | 223.55 | 0.64 | 337 | 61 | 0.127 |
| 9 | 3.790 | 5.455 | 235.78 | 0.62 | 339 | 61 | 0.070 |
| 10 | 2.541 | 4.492 | 248.02 | 0.61 | 341 | 60 | 0.030 |
| 11 | +1.196 | 3.343 | 260.26 | 0.59 | 344 | 56 | 0.006 |
| 12 | -0.205 | 2.055 | 272.50 | 0.57 | 347 | 290 | 0.001 |
| 13 | -1.625 | +0.681 | 284.74 | -0.55 | 351 | 262 | 0.013 |
| 14 | 3.019 | -0.726 | 296.98 | 0.53 | 356 | 263 | 0.043 |
| 15 | 4.338 | 2.110 | 309.22 | 0.50 | 1 | 267 | 0.090 |
| 16 | 5.529 | 3.414 | 321.45 | 0.48 | 6 | 272 | 0.153 |
| 17 | 6.533 | -4.582 | 333.68 | -0.45 | 11 | 278 | 0.230 |

**MOON, 2021**
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR $0^h$ TERRESTRIAL TIME

| Date $0^h$ TT | The Earth's Selenographic | | The Sun's Selenographic | | Position Angle of | | Fraction Illuminated |
|---|---|---|---|---|---|---|---|
| | Long. | Lat. | Colong. | Lat. | Axis | Bright Limb | |
| | ° | ° | ° | ° | ° | ° | |
| May 17 | -6.533 | -4.582 | 333.68 | -0.45 | 11 | 278 | 0.230 |
| 18 | 7.285 | 5.557 | 345.91 | 0.42 | 16 | 283 | 0.319 |
| 19 | 7.723 | 6.284 | 358.13 | 0.39 | 19 | 288 | 0.418 |
| 20 | 7.790 | 6.709 | 10.34 | 0.36 | 22 | 292 | 0.522 |
| 21 | 7.444 | 6.780 | 22.55 | 0.33 | 23 | 294 | 0.630 |
| 22 | 6.667 | 6.461 | 34.75 | 0.29 | 23 | 296 | 0.734 |
| 23 | -5.472 | -5.732 | 46.94 | -0.25 | 22 | 297 | 0.830 |
| 24 | 3.914 | 4.610 | 59.13 | 0.22 | 20 | 296 | 0.909 |
| 25 | 2.089 | 3.151 | 71.32 | 0.18 | 16 | 294 | 0.967 |
| 26 | -0.124 | -1.452 | 83.50 | 0.14 | 11 | 292 | 0.997 |
| 27 | +1.836 | +0.351 | 95.68 | 0.10 | 6 | 99 | 0.996 |
| 28 | 3.645 | 2.115 | 107.86 | 0.07 | 359 | 95 | 0.965 |
| 29 | +5.181 | +3.707 | 120.05 | -0.03 | 353 | 88 | 0.908 |
| 30 | 6.352 | 5.024 | 132.24 | +0.00 | 347 | 82 | 0.829 |
| 31 | 7.105 | 6.002 | 144.44 | 0.02 | 343 | 76 | 0.737 |
| June 1 | 7.427 | 6.615 | 156.64 | 0.05 | 340 | 71 | 0.636 |
| 2 | 7.334 | 6.864 | 168.85 | 0.07 | 338 | 68 | 0.533 |
| 3 | 6.867 | 6.769 | 181.07 | 0.09 | 337 | 66 | 0.432 |
| 4 | +6.083 | +6.360 | 193.30 | +0.11 | 337 | 65 | 0.335 |
| 5 | 5.046 | 5.674 | 205.53 | 0.12 | 338 | 65 | 0.247 |
| 6 | 3.822 | 4.751 | 217.76 | 0.14 | 340 | 66 | 0.169 |
| 7 | 2.474 | 3.633 | 230.00 | 0.16 | 343 | 68 | 0.104 |
| 8 | +1.064 | 2.367 | 242.25 | 0.17 | 346 | 71 | 0.054 |
| 9 | -0.354 | +1.001 | 254.50 | 0.19 | 350 | 76 | 0.019 |
| 10 | -1.731 | -0.411 | 266.75 | 0.21 | 355 | 87 | 0.002 |
| 11 | -3.021 | -1.813 | 279.00 | +0.23 | 360 | 255 | 0.003 |
| 12 | 4.185 | 3.146 | 291.25 | 0.25 | 5 | 266 | 0.023 |
| 13 | 5.184 | 4.352 | 303.49 | 0.28 | 10 | 273 | 0.061 |
| 14 | 5.985 | 5.371 | 315.74 | 0.30 | 15 | 279 | 0.117 |
| 15 | 6.552 | -6.148 | 327.98 | 0.33 | 18 | 284 | 0.190 |
| 16 | -6.855 | -6.634 | 340.22 | +0.36 | 21 | 288 | 0.277 |
| 17 | 6.864 | 6.786 | 352.45 | 0.39 | 23 | 291 | 0.376 |
| 18 | 6.558 | 6.572 | 4.67 | 0.42 | 23 | 293 | 0.483 |
| 19 | 5.923 | 5.978 | 16.89 | 0.45 | 22 | 294 | 0.594 |
| 20 | 4.963 | 5.010 | 29.10 | 0.49 | 21 | 293 | 0.703 |
| 21 | 3.702 | 3.705 | 41.30 | 0.52 | 18 | 291 | 0.804 |
| 22 | -2.189 | -2.133 | 53.50 | +0.56 | 13 | 287 | 0.890 |
| 23 | -0.505 | -0.396 | 65.69 | 0.60 | 8 | 280 | 0.954 |
| 24 | +1.248 | +1.376 | 77.88 | 0.63 | 2 | 268 | 0.991 |
| 25 | 2.946 | 3.048 | 90.07 | 0.67 | 356 | 124 | 0.999 |
| 26 | 4.465 | 4.495 | 102.26 | 0.70 | 350 | 92 | 0.978 |
| 27 | 5.692 | 5.625 | 114.45 | 0.73 | 345 | 83 | 0.931 |
| 28 | +6.542 | +6.385 | 126.65 | +0.76 | 341 | 76 | 0.863 |
| 29 | 6.967 | 6.760 | 138.85 | 0.78 | 338 | 72 | 0.780 |
| 30 | 6.957 | 6.765 | 151.06 | 0.80 | 337 | 69 | 0.687 |
| July 1 | 6.541 | 6.433 | 163.27 | 0.82 | 337 | 67 | 0.589 |
| 2 | 5.769 | +5.807 | 175.49 | +0.84 | 338 | 67 | 0.490 |

**MOON, 2021**
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR $0^h$ TERRESTRIAL TIME

| Date $0^h$ TT | | The Earth's Selenographic Long. | The Earth's Selenographic Lat. | The Sun's Selenographic Colong. | The Sun's Selenographic Lat. | Position Angle of Axis | Position Angle of Bright Limb | Fraction Illuminated |
|---|---|---|---|---|---|---|---|---|
| | | ° | ° | ° | ° | ° | ° | |
| July | 1 | +6.541 | +6.433 | 163.27 | +0.82 | 337 | 67 | 0.589 |
| | 2 | 5.769 | 5.807 | 175.49 | 0.84 | 338 | 67 | 0.490 |
| | 3 | 4.714 | 4.935 | 187.71 | 0.85 | 340 | 68 | 0.393 |
| | 4 | 3.455 | 3.861 | 199.94 | 0.86 | 342 | 70 | 0.302 |
| | 5 | 2.075 | 2.634 | 212.18 | 0.88 | 345 | 72 | 0.219 |
| | 6 | +0.655 | +1.299 | 224.42 | 0.89 | 349 | 77 | 0.146 |
| | 7 | -0.732 | -0.092 | 236.67 | +0.90 | 354 | 82 | 0.086 |
| | 8 | 2.021 | 1.487 | 248.92 | 0.91 | 358 | 90 | 0.040 |
| | 9 | 3.159 | 2.829 | 261.17 | 0.93 | 4 | 102 | 0.011 |
| | 10 | 4.105 | 4.059 | 273.42 | 0.94 | 9 | 176 | 0.001 |
| | 11 | 4.833 | 5.113 | 285.67 | 0.96 | 13 | 263 | 0.010 |
| | 12 | 5.329 | 5.934 | 297.92 | 0.97 | 17 | 276 | 0.040 |
| | 13 | -5.589 | -6.469 | 310.17 | +0.99 | 20 | 283 | 0.090 |
| | 14 | 5.618 | 6.674 | 322.42 | 1.01 | 22 | 287 | 0.159 |
| | 15 | 5.424 | 6.523 | 334.66 | 1.03 | 23 | 290 | 0.245 |
| | 16 | 5.016 | 6.007 | 346.89 | 1.06 | 23 | 292 | 0.344 |
| | 17 | 4.401 | 5.137 | 359.12 | 1.08 | 21 | 292 | 0.453 |
| | 18 | 3.586 | 3.948 | 11.34 | 1.11 | 19 | 290 | 0.567 |
| | 19 | -2.582 | -2.499 | 23.55 | +1.14 | 15 | 287 | 0.678 |
| | 20 | 1.407 | -0.874 | 35.75 | 1.16 | 10 | 282 | 0.782 |
| | 21 | -0.098 | +0.823 | 47.95 | 1.19 | 4 | 275 | 0.871 |
| | 22 | +1.288 | 2.473 | 60.15 | 1.22 | 358 | 266 | 0.939 |
| | 23 | 2.669 | 3.960 | 72.34 | 1.25 | 352 | 252 | 0.982 |
| | 24 | 3.944 | 5.178 | 84.53 | 1.28 | 347 | 188 | 0.999 |
| | 25 | +5.010 | +6.055 | 96.71 | +1.30 | 342 | 94 | 0.988 |
| | 26 | 5.772 | 6.552 | 108.90 | 1.32 | 339 | 80 | 0.953 |
| | 27 | 6.164 | 6.666 | 121.10 | 1.34 | 337 | 74 | 0.896 |
| | 28 | 6.153 | 6.421 | 133.29 | 1.35 | 337 | 71 | 0.824 |
| | 29 | 5.747 | 5.862 | 145.50 | 1.36 | 338 | 69 | 0.740 |
| | 30 | 4.984 | 5.039 | 157.70 | 1.37 | 339 | 69 | 0.649 |
| | 31 | +3.929 | +4.006 | 169.92 | +1.38 | 341 | 70 | 0.554 |
| Aug. | 1 | 2.666 | 2.814 | 182.13 | 1.38 | 344 | 73 | 0.459 |
| | 2 | +1.284 | 1.513 | 194.36 | 1.39 | 348 | 76 | 0.366 |
| | 3 | -0.122 | +0.152 | 206.59 | 1.39 | 352 | 81 | 0.277 |
| | 4 | 1.464 | -1.220 | 218.82 | 1.39 | 357 | 86 | 0.196 |
| | 5 | 2.660 | -2.552 | 231.06 | 1.39 | 2 | 93 | 0.126 |
| | 6 | -3.642 | -3.786 | 243.31 | +1.40 | 7 | 101 | 0.069 |
| | 7 | 4.364 | 4.862 | 255.55 | 1.40 | 12 | 112 | 0.028 |
| | 8 | 4.798 | 5.719 | 267.80 | 1.40 | 16 | 138 | 0.005 |
| | 9 | 4.942 | 6.298 | 280.05 | 1.41 | 20 | 246 | 0.004 |
| | 10 | 4.818 | 6.550 | 292.29 | 1.42 | 22 | 276 | 0.025 |
| | 11 | 4.464 | 6.443 | 304.54 | 1.42 | 23 | 285 | 0.069 |
| | 12 | -3.929 | -5.967 | 316.78 | +1.43 | 23 | 289 | 0.134 |
| | 13 | 3.259 | 5.138 | 329.01 | 1.44 | 22 | 290 | 0.219 |
| | 14 | 2.494 | 3.995 | 341.24 | 1.45 | 19 | 289 | 0.318 |
| | 15 | 1.658 | 2.603 | 353.46 | 1.46 | 16 | 287 | 0.428 |
| | 16 | -0.764 | -1.045 | 5.68 | +1.48 | 11 | 283 | 0.543 |

**MOON, 2021**
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR $0^h$ TERRESTRIAL TIME

| Date $0^h$ TT | | The Earth's Selenographic | | The Sun's Selenographic | | Position Angle of | | Fraction Illuminated |
|---|---|---|---|---|---|---|---|---|
| | | Long. | Lat. | Colong. | Lat. | Axis | Bright Limb | |
| | | ° | ° | ° | ° | ° | ° | |
| Aug. | 16 | -0.764 | -1.045 | 5.68 | +1.48 | 11 | 283 | 0.543 |
| | 17 | +0.181 | +0.586 | 17.88 | 1.49 | 6 | 277 | 0.655 |
| | 18 | 1.165 | 2.184 | 30.08 | 1.51 | 0 | 271 | 0.760 |
| | 19 | 2.166 | 3.647 | 42.28 | 1.53 | 354 | 263 | 0.850 |
| | 20 | 3.141 | 4.881 | 54.47 | 1.54 | 348 | 254 | 0.922 |
| | 21 | 4.030 | 5.810 | 66.65 | 1.56 | 344 | 242 | 0.971 |
| | 22 | +4.756 | +6.383 | 78.83 | +1.57 | 340 | 213 | 0.995 |
| | 23 | 5.246 | 6.580 | 91.01 | 1.58 | 338 | 106 | 0.995 |
| | 24 | 5.436 | 6.413 | 103.20 | 1.58 | 337 | 81 | 0.972 |
| | 25 | 5.287 | 5.914 | 115.38 | 1.58 | 337 | 74 | 0.929 |
| | 26 | 4.794 | 5.133 | 127.57 | 1.59 | 338 | 72 | 0.869 |
| | 27 | 3.980 | 4.127 | 139.76 | 1.58 | 340 | 71 | 0.796 |
| | 28 | +2.897 | +2.953 | 151.95 | +1.58 | 343 | 73 | 0.713 |
| | 29 | 1.618 | 1.666 | 164.15 | 1.57 | 347 | 75 | 0.623 |
| | 30 | +0.231 | +0.319 | 176.36 | 1.57 | 351 | 79 | 0.530 |
| | 31 | -1.170 | -1.041 | 188.57 | 1.56 | 355 | 84 | 0.435 |
| Sept. | 1 | 2.486 | 2.362 | 200.78 | 1.55 | 0 | 89 | 0.343 |
| | 2 | 3.626 | -3.595 | 213.00 | 1.54 | 5 | 96 | 0.254 |
| | 3 | -4.508 | -4.685 | 225.23 | +1.53 | 10 | 102 | 0.174 |
| | 4 | 5.069 | 5.573 | 237.46 | 1.52 | 15 | 110 | 0.105 |
| | 5 | 5.272 | 6.201 | 249.69 | 1.51 | 19 | 118 | 0.050 |
| | 6 | 5.113 | 6.511 | 261.93 | 1.50 | 21 | 132 | 0.015 |
| | 7 | 4.621 | 6.462 | 274.17 | 1.49 | 23 | 197 | 0.002 |
| | 8 | 3.858 | 6.032 | 286.40 | 1.49 | 23 | 273 | 0.013 |
| | 9 | -2.905 | -5.228 | 298.64 | +1.48 | 22 | 285 | 0.050 |
| | 10 | 1.848 | 4.092 | 310.87 | 1.47 | 20 | 287 | 0.112 |
| | 11 | -0.765 | 2.694 | 323.09 | 1.47 | 17 | 286 | 0.194 |
| | 12 | +0.286 | -1.125 | 335.31 | 1.47 | 12 | 284 | 0.293 |
| | 13 | 1.272 | +0.509 | 347.52 | 1.47 | 7 | 279 | 0.403 |
| | 14 | 2.175 | 2.105 | 359.73 | 1.47 | 2 | 273 | 0.517 |
| | 15 | +2.991 | +3.564 | 11.92 | +1.47 | 356 | 266 | 0.629 |
| | 16 | 3.713 | 4.801 | 24.11 | 1.47 | 350 | 259 | 0.734 |
| | 17 | 4.328 | 5.747 | 36.30 | 1.47 | 345 | 252 | 0.825 |
| | 18 | 4.812 | 6.356 | 48.48 | 1.47 | 341 | 245 | 0.900 |
| | 19 | 5.127 | 6.604 | 60.65 | 1.46 | 339 | 238 | 0.954 |
| | 20 | 5.234 | 6.491 | 72.82 | 1.46 | 337 | 225 | 0.987 |
| | 21 | +5.097 | +6.042 | 84.99 | +1.45 | 337 | 156 | 0.998 |
| | 22 | 4.690 | 5.298 | 97.16 | 1.44 | 338 | 86 | 0.988 |
| | 23 | 4.008 | 4.311 | 109.33 | 1.43 | 340 | 76 | 0.959 |
| | 24 | 3.068 | 3.141 | 121.50 | 1.42 | 342 | 74 | 0.912 |
| | 25 | 1.909 | 1.847 | 133.67 | 1.40 | 345 | 75 | 0.850 |
| | 26 | +0.588 | +0.488 | 145.85 | 1.38 | 349 | 78 | 0.776 |
| | 27 | -0.821 | -0.884 | 158.03 | +1.37 | 354 | 82 | 0.693 |
| | 28 | 2.231 | 2.218 | 170.22 | 1.35 | 359 | 87 | 0.603 |
| | 29 | 3.551 | 3.465 | 182.41 | 1.33 | 4 | 92 | 0.509 |
| | 30 | 4.687 | 4.577 | 194.61 | 1.30 | 9 | 98 | 0.413 |
| Oct. | 1 | -5.550 | -5.501 | 206.82 | +1.28 | 13 | 104 | 0.318 |

**MOON, 2021**
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR $0^h$ TERRESTRIAL TIME

| Date $0^h$ TT | | The Earth's Selenographic Long. | The Earth's Selenographic Lat. | The Sun's Selenographic Colong. | The Sun's Selenographic Lat. | Position Angle of Axis | Position Angle of Bright Limb | Fraction Illuminated |
|---|---|---|---|---|---|---|---|---|
| | | ° | ° | ° | ° | ° | ° | |
| Oct. | 1 | -5.550 | -5.501 | 206.82 | +1.28 | 13 | 104 | 0.318 |
| | 2 | 6.064 | 6.183 | 219.02 | 1.26 | 17 | 110 | 0.228 |
| | 3 | 6.177 | 6.569 | 231.24 | 1.24 | 20 | 115 | 0.147 |
| | 4 | 5.865 | 6.610 | 243.46 | 1.22 | 22 | 120 | 0.080 |
| | 5 | 5.145 | 6.269 | 255.68 | 1.20 | 23 | 127 | 0.030 |
| | 6 | 4.077 | 5.535 | 267.90 | 1.18 | 22 | 147 | 0.004 |
| | 7 | -2.753 | -4.433 | 280.12 | +1.16 | 21 | 267 | 0.005 |
| | 8 | -1.286 | 3.026 | 292.34 | 1.14 | 18 | 283 | 0.034 |
| | 9 | +0.208 | -1.410 | 304.56 | 1.12 | 14 | 284 | 0.089 |
| | 10 | 1.629 | +0.295 | 316.77 | 1.10 | 9 | 281 | 0.168 |
| | 11 | 2.902 | 1.968 | 328.97 | 1.09 | 3 | 275 | 0.265 |
| | 12 | 3.979 | 3.496 | 341.17 | 1.07 | 357 | 269 | 0.373 |
| | 13 | +4.837 | +4.789 | 353.37 | +1.06 | 351 | 262 | 0.485 |
| | 14 | 5.466 | 5.781 | 5.55 | 1.04 | 346 | 256 | 0.596 |
| | 15 | 5.868 | 6.430 | 17.73 | 1.03 | 342 | 250 | 0.700 |
| | 16 | 6.044 | 6.720 | 29.90 | 1.02 | 339 | 245 | 0.792 |
| | 17 | 5.995 | 6.652 | 42.06 | 1.00 | 338 | 242 | 0.870 |
| | 18 | 5.721 | 6.247 | 54.22 | 0.99 | 337 | 238 | 0.931 |
| | 19 | +5.222 | +5.541 | 66.38 | +0.97 | 338 | 234 | 0.973 |
| | 20 | 4.505 | 4.581 | 78.54 | 0.95 | 339 | 222 | 0.995 |
| | 21 | 3.579 | 3.422 | 90.69 | 0.92 | 341 | 102 | 0.998 |
| | 22 | 2.466 | 2.123 | 102.84 | 0.90 | 344 | 79 | 0.982 |
| | 23 | +1.200 | +0.744 | 115.00 | 0.88 | 348 | 78 | 0.949 |
| | 24 | -0.175 | -0.656 | 127.16 | 0.85 | 352 | 80 | 0.899 |
| | 25 | -1.602 | -2.022 | 139.32 | +0.82 | 357 | 84 | 0.836 |
| | 26 | 3.014 | 3.305 | 151.48 | 0.79 | 2 | 89 | 0.761 |
| | 27 | 4.335 | 4.453 | 163.65 | 0.76 | 7 | 95 | 0.676 |
| | 28 | 5.484 | 5.422 | 175.82 | 0.74 | 12 | 100 | 0.583 |
| | 29 | 6.378 | 6.163 | 188.00 | 0.71 | 16 | 105 | 0.485 |
| | 30 | 6.941 | 6.630 | 200.19 | 0.68 | 19 | 110 | 0.386 |
| | 31 | -7.108 | -6.776 | 212.37 | +0.65 | 22 | 114 | 0.287 |
| Nov. | 1 | 6.836 | 6.563 | 224.57 | 0.62 | 23 | 117 | 0.195 |
| | 2 | 6.113 | 5.964 | 236.77 | 0.59 | 23 | 119 | 0.115 |
| | 3 | 4.971 | 4.980 | 248.97 | 0.56 | 22 | 120 | 0.052 |
| | 4 | 3.478 | 3.646 | 261.18 | 0.53 | 19 | 123 | 0.012 |
| | 5 | -1.745 | 2.040 | 273.39 | 0.50 | 16 | 243 | 0.000 |
| | 6 | +0.098 | -0.277 | 285.59 | +0.47 | 11 | 282 | 0.019 |
| | 7 | 1.912 | +1.505 | 297.80 | 0.45 | 5 | 279 | 0.066 |
| | 8 | 3.574 | 3.167 | 310.00 | 0.42 | 359 | 273 | 0.138 |
| | 9 | 4.984 | 4.594 | 322.19 | 0.40 | 353 | 266 | 0.230 |
| | 10 | 6.076 | 5.702 | 334.38 | 0.37 | 347 | 260 | 0.334 |
| | 11 | 6.817 | 6.444 | 346.56 | 0.35 | 343 | 254 | 0.443 |
| | 12 | +7.199 | +6.806 | 358.73 | +0.33 | 340 | 249 | 0.552 |
| | 13 | 7.239 | 6.796 | 10.90 | 0.30 | 338 | 246 | 0.655 |
| | 14 | 6.963 | 6.443 | 23.06 | 0.28 | 337 | 244 | 0.749 |
| | 15 | 6.409 | 5.783 | 35.21 | 0.26 | 337 | 243 | 0.831 |
| | 16 | +5.614 | +4.863 | 47.36 | +0.23 | 339 | 243 | 0.898 |

**MOON, 2021**
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR $0^h$ TERRESTRIAL TIME

| Date $0^h$ TT | | The Earth's Selenographic Long. | The Earth's Selenographic Lat. | The Sun's Selenographic Colong. | The Sun's Selenographic Lat. | Position Angle of Axis | Position Angle of Bright Limb | Fraction Illuminated |
|---|---|---|---|---|---|---|---|---|
| | | ° | ° | ° | ° | ° | ° | |
| Nov. | 16 | +5.614 | +4.863 | 47.36 | +0.23 | 339 | 243 | 0.898 |
| | 17 | 4.619 | 3.735 | 59.51 | 0.20 | 341 | 244 | 0.949 |
| | 18 | 3.463 | 2.454 | 71.65 | 0.18 | 343 | 245 | 0.983 |
| | 19 | 2.183 | +1.077 | 83.79 | 0.15 | 347 | 244 | 0.999 |
| | 20 | +0.819 | -0.337 | 95.93 | 0.12 | 351 | 77 | 0.997 |
| | 21 | -0.589 | -1.731 | 108.07 | 0.09 | 356 | 80 | 0.977 |
| | 22 | -1.999 | -3.049 | 120.21 | +0.06 | 1 | 85 | 0.940 |
| | 23 | 3.363 | 4.240 | 132.36 | 0.03 | 6 | 90 | 0.888 |
| | 24 | 4.629 | 5.256 | 144.50 | +0.00 | 11 | 96 | 0.821 |
| | 25 | 5.740 | 6.052 | 156.65 | -0.03 | 15 | 102 | 0.742 |
| | 26 | 6.633 | 6.586 | 168.81 | 0.06 | 18 | 106 | 0.652 |
| | 27 | -7.247 | -6.820 | 180.97 | 0.09 | 21 | 110 | 0.554 |
| | 28 | -7.522 | -6.723 | 193.14 | -0.12 | 22 | 113 | 0.452 |
| | 29 | 7.406 | 6.270 | 205.31 | 0.15 | 23 | 115 | 0.347 |
| | 30 | 6.866 | 5.450 | 217.49 | 0.18 | 22 | 116 | 0.247 |
| Dec. | 1 | 5.894 | 4.277 | 229.67 | 0.22 | 20 | 115 | 0.155 |
| | 2 | 4.516 | 2.796 | 241.86 | 0.25 | 17 | 112 | 0.080 |
| | 3 | -2.802 | -1.091 | 254.06 | 0.28 | 13 | 107 | 0.027 |
| | 4 | -0.860 | +0.716 | 266.25 | -0.31 | 8 | 93 | 0.002 |
| | 5 | +1.170 | 2.482 | 278.45 | 0.34 | 2 | 284 | 0.007 |
| | 6 | 3.130 | 4.064 | 290.64 | 0.37 | 355 | 274 | 0.043 |
| | 7 | 4.873 | 5.343 | 302.83 | 0.39 | 349 | 265 | 0.106 |
| | 8 | 6.275 | 6.243 | 315.02 | 0.42 | 344 | 259 | 0.189 |
| | 9 | 7.258 | 6.733 | 327.20 | 0.45 | 341 | 253 | 0.285 |
| | 10 | +7.785 | +6.821 | 339.37 | -0.47 | 338 | 249 | 0.389 |
| | 11 | 7.865 | 6.539 | 351.54 | 0.50 | 337 | 247 | 0.494 |
| | 12 | 7.535 | 5.935 | 3.70 | 0.52 | 337 | 246 | 0.596 |
| | 13 | 6.854 | 5.063 | 15.85 | 0.55 | 338 | 246 | 0.692 |
| | 14 | 5.892 | 3.977 | 28.00 | 0.57 | 340 | 247 | 0.778 |
| | 15 | 4.720 | 2.732 | 40.14 | 0.60 | 343 | 249 | 0.852 |
| | 16 | +3.406 | +1.383 | 52.28 | -0.62 | 346 | 253 | 0.913 |
| | 17 | 2.012 | -0.015 | 64.42 | 0.65 | 350 | 258 | 0.958 |
| | 18 | +0.594 | 1.407 | 76.55 | 0.67 | 354 | 268 | 0.987 |
| | 19 | -0.804 | 2.738 | 88.68 | 0.70 | 359 | 313 | 0.999 |
| | 20 | 2.140 | 3.954 | 100.81 | 0.72 | 4 | 74 | 0.994 |
| | 21 | 3.383 | 5.004 | 112.94 | 0.75 | 9 | 88 | 0.970 |
| | 22 | -4.502 | -5.840 | 125.08 | -0.77 | 14 | 95 | 0.929 |
| | 23 | 5.466 | 6.422 | 137.21 | 0.80 | 18 | 102 | 0.871 |
| | 24 | 6.245 | 6.713 | 149.35 | 0.82 | 20 | 106 | 0.799 |
| | 25 | 6.803 | 6.688 | 161.50 | 0.85 | 22 | 110 | 0.713 |
| | 26 | 7.104 | 6.330 | 173.65 | 0.87 | 23 | 112 | 0.616 |
| | 27 | 7.105 | 5.634 | 185.80 | 0.89 | 23 | 113 | 0.512 |
| | 28 | -6.769 | -4.611 | 197.96 | -0.92 | 21 | 113 | 0.404 |
| | 29 | 6.067 | 3.292 | 210.13 | 0.94 | 19 | 111 | 0.297 |
| | 30 | 4.989 | 1.734 | 222.31 | 0.97 | 15 | 108 | 0.197 |
| | 31 | 3.554 | -0.026 | 234.49 | 0.99 | 11 | 102 | 0.112 |
| | 32 | -1.821 | +1.717 | 246.67 | -1.01 | 5 | 94 | 0.047 |

**MERCURY, 2021**
HELIOCENTRIC POSITIONS FOR $0^h$ TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

| Date | | Heliocentric Longitude | | | Heliocentric Latitude | | | Radius Vector | Date | | Heliocentric Longitude | | | Heliocentric Latitude | | | Radius Vector |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | | ° | ' | " | ° | ' | " | |
| Jan. | 0 | 300 | 36 | 03.0 | -6 | 39 | 59.0 | 0.436 4268 | Feb. | 15 | 170 | 43 | 28.4 | +5 | 56 | 23.8 | 0.374 4162 |
| | 1 | 303 | 48 | 04.0 | 6 | 46 | 32.7 | 0.432 3533 | | 16 | 174 | 57 | 06.6 | 5 | 39 | 02.1 | 0.380 2037 |
| | 2 | 307 | 03 | 55.2 | 6 | 51 | 56.5 | 0.428 0543 | | 17 | 179 | 02 | 54.8 | 5 | 20 | 26.6 | 0.385 9404 |
| | 3 | 310 | 23 | 55.1 | 6 | 56 | 05.0 | 0.423 5391 | | 18 | 183 | 01 | 18.9 | 5 | 00 | 50.0 | 0.391 5991 |
| | 4 | 313 | 48 | 22.6 | 6 | 58 | 52.5 | 0.418 8183 | | 19 | 186 | 52 | 44.8 | 4 | 40 | 24.1 | 0.397 1552 |
| | 5 | 317 | 17 | 37.6 | 7 | 00 | 12.9 | 0.413 9040 | | 20 | 190 | 37 | 38.2 | 4 | 19 | 18.8 | 0.402 5866 |
| | 6 | 320 | 52 | 00.5 | -6 | 59 | 59.3 | 0.408 8096 | | 21 | 194 | 16 | 24.7 | +3 | 57 | 43.1 | 0.407 8737 |
| | 7 | 324 | 31 | 52.5 | 6 | 58 | 04.6 | 0.403 5505 | | 22 | 197 | 49 | 28.9 | 3 | 35 | 44.7 | 0.412 9990 |
| | 8 | 328 | 17 | 35.3 | 6 | 54 | 21.2 | 0.398 1438 | | 23 | 201 | 17 | 14.8 | 3 | 13 | 30.2 | 0.417 9468 |
| | 9 | 332 | 09 | 31.1 | 6 | 48 | 41.0 | 0.392 6087 | | 24 | 204 | 40 | 05.6 | 2 | 51 | 05.5 | 0.422 7035 |
| | 10 | 336 | 08 | 02.2 | 6 | 40 | 55.7 | 0.386 9668 | | 25 | 207 | 58 | 23.4 | 2 | 28 | 35.7 | 0.427 2565 |
| | 11 | 340 | 13 | 31.3 | 6 | 30 | 56.8 | 0.381 2423 | | 26 | 211 | 12 | 29.4 | 2 | 06 | 04.9 | 0.431 5953 |
| | 12 | 344 | 26 | 20.7 | -6 | 18 | 35.5 | 0.375 4618 | | 27 | 214 | 22 | 44.0 | +1 | 43 | 36.8 | 0.435 7101 |
| | 13 | 348 | 46 | 52.1 | 6 | 03 | 43.6 | 0.369 6551 | | 28 | 217 | 29 | 26.5 | 1 | 21 | 14.9 | 0.439 5925 |
| | 14 | 353 | 15 | 26.2 | 5 | 46 | 13.0 | 0.363 8550 | Mar. | 1 | 220 | 32 | 55.3 | 0 | 59 | 01.6 | 0.443 2350 |
| | 15 | 357 | 52 | 22.4 | 5 | 25 | 56.7 | 0.358 0974 | | 2 | 223 | 33 | 28.3 | 0 | 36 | 59.6 | 0.446 6313 |
| | 16 | 2 | 37 | 57.4 | 5 | 02 | 49.0 | 0.352 4215 | | 3 | 226 | 31 | 22.3 | +0 | 15 | 10.7 | 0.449 7755 |
| | 17 | 7 | 32 | 25.1 | -4 | 36 | 45.7 | 0.346 8696 | | 4 | 229 | 26 | 53.5 | -0 | 06 | 23.2 | 0.452 6627 |
| | 18 | 12 | 35 | 55.5 | 4 | 07 | 45.5 | 0.341 4870 | | 5 | 232 | 20 | 17.3 | -0 | 27 | 40.3 | 0.455 2885 |
| | 19 | 17 | 48 | 33.6 | 3 | 35 | 50.1 | 0.336 3220 | | 6 | 235 | 11 | 48.8 | 0 | 48 | 39.5 | 0.457 6492 |
| | 20 | 23 | 10 | 18.2 | 3 | 01 | 05.1 | 0.331 4247 | | 7 | 238 | 01 | 42.4 | 1 | 09 | 19.3 | 0.459 7417 |
| | 21 | 28 | 41 | 01.1 | 2 | 23 | 40.8 | 0.326 8469 | | 8 | 240 | 50 | 11.9 | 1 | 29 | 38.5 | 0.461 5631 |
| | 22 | 34 | 20 | 25.8 | 1 | 43 | 52.8 | 0.322 6410 | | 9 | 243 | 37 | 31.0 | 1 | 49 | 36.1 | 0.463 1111 |
| | 23 | 40 | 08 | 06.3 | 1 | 02 | 02.1 | 0.318 8586 | | 10 | 246 | 23 | 52.7 | 2 | 09 | 11.0 | 0.464 3840 |
| | 24 | 46 | 03 | 26.8 | -0 | 18 | 35.8 | 0.315 5493 | | 11 | 249 | 09 | 30.0 | -2 | 28 | 22.2 | 0.465 3802 |
| | 25 | 52 | 05 | 40.7 | +0 | 25 | 53.4 | 0.312 7593 | | 12 | 251 | 54 | 35.4 | 2 | 47 | 08.6 | 0.466 0985 |
| | 26 | 58 | 13 | 50.7 | 1 | 10 | 48.0 | 0.310 5295 | | 13 | 254 | 39 | 21.4 | 3 | 05 | 29.3 | 0.466 5381 |
| | 27 | 64 | 26 | 49.6 | 1 | 55 | 26.7 | 0.308 8938 | | 14 | 257 | 24 | 00.4 | 3 | 23 | 23.0 | 0.466 6985 |
| | 28 | 70 | 43 | 21.0 | 2 | 39 | 05.8 | 0.307 8782 | | 15 | 260 | 08 | 44.5 | 3 | 40 | 48.7 | 0.466 5796 |
| | 29 | 77 | 02 | 01.2 | 3 | 21 | 01.7 | 0.307 4990 | | 16 | 262 | 53 | 45.9 | 3 | 57 | 45.2 | 0.466 1815 |
| | 30 | 83 | 21 | 21.4 | +4 | 00 | 32.4 | 0.307 7624 | | 17 | 265 | 39 | 16.8 | -4 | 14 | 11.1 | 0.465 5046 |
| | 31 | 89 | 39 | 50.6 | 4 | 36 | 59.9 | 0.308 6642 | | 18 | 268 | 25 | 29.6 | 4 | 30 | 05.0 | 0.464 5497 |
| Feb. | 1 | 95 | 55 | 58.5 | 5 | 09 | 51.9 | 0.310 1897 | | 19 | 271 | 12 | 36.6 | 4 | 45 | 25.4 | 0.463 3179 |
| | 2 | 102 | 08 | 18.3 | 5 | 38 | 43.3 | 0.312 3147 | | 20 | 274 | 00 | 50.5 | 5 | 00 | 10.6 | 0.461 8106 |
| | 3 | 108 | 15 | 29.8 | 6 | 03 | 16.7 | 0.315 0065 | | 21 | 276 | 50 | 23.9 | 5 | 14 | 18.8 | 0.460 0297 |
| | 4 | 114 | 16 | 21.2 | 6 | 23 | 22.7 | 0.318 2254 | | 22 | 279 | 41 | 30.1 | 5 | 27 | 47.8 | 0.457 9775 |
| | 5 | 120 | 09 | 51.3 | +6 | 38 | 59.4 | 0.321 9261 | | 23 | 282 | 34 | 22.4 | -5 | 40 | 35.4 | 0.455 6565 |
| | 6 | 125 | 55 | 10.0 | 6 | 50 | 11.8 | 0.326 0595 | | 24 | 285 | 29 | 14.6 | 5 | 52 | 39.1 | 0.453 0699 |
| | 7 | 131 | 31 | 38.8 | 6 | 57 | 10.2 | 0.330 5741 | | 25 | 288 | 26 | 20.9 | 6 | 03 | 56.2 | 0.450 2213 |
| | 8 | 136 | 58 | 50.7 | 7 | 00 | 09.4 | 0.335 4177 | | 26 | 291 | 25 | 55.9 | 6 | 14 | 23.6 | 0.447 1150 |
| | 9 | 142 | 16 | 29.1 | 6 | 59 | 27.3 | 0.340 5382 | | 27 | 294 | 28 | 15.0 | 6 | 23 | 57.9 | 0.443 7560 |
| | 10 | 147 | 24 | 27.2 | 6 | 55 | 23.5 | 0.345 8852 | | 28 | 297 | 33 | 33.7 | 6 | 32 | 35.6 | 0.440 1496 |
| | 11 | 152 | 22 | 46.0 | +6 | 48 | 18.3 | 0.351 4101 | | 29 | 300 | 42 | 08.6 | -6 | 40 | 12.4 | 0.436 3025 |
| | 12 | 157 | 11 | 33.9 | 6 | 38 | 32.5 | 0.357 0669 | | 30 | 303 | 54 | 16.5 | 6 | 46 | 44.0 | 0.432 2218 |
| | 13 | 161 | 51 | 04.4 | 6 | 26 | 25.7 | 0.362 8129 | | 31 | 307 | 10 | 15.3 | 6 | 52 | 05.4 | 0.427 9158 |
| | 14 | 166 | 21 | 35.4 | 6 | 12 | 17.0 | 0.368 6081 | Apr. | 1 | 310 | 30 | 23.2 | 6 | 56 | 11.5 | 0.423 3940 |
| | 15 | 170 | 43 | 28.4 | +5 | 56 | 23.8 | 0.374 4162 | | 2 | 313 | 54 | 59.4 | -6 | 58 | 56.5 | 0.418 6670 |

**MERCURY, 2021**
HELIOCENTRIC POSITIONS FOR $0^h$ TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

| Date | | Heliocentric Longitude | | | Heliocentric Latitude | | | Radius Vector | Date | | Heliocentric Longitude | | | Heliocentric Latitude | | | Radius Vector |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ′ | ″ | ° | ′ | ″ | | | | ° | ′ | ″ | ° | ′ | ″ | |
| Apr. | 1 | 310 | 30 | 23.2 | -6 | 56 | 11.5 | 0.423 3940 | May | 17 | 183 | 08 | 47.3 | +5 | 00 | 12.6 | 0.391 7750 |
| | 2 | 313 | 54 | 59.4 | 6 | 58 | 56.5 | 0.418 6670 | | 18 | 187 | 00 | 00.5 | 4 | 39 | 45.3 | 0.397 3274 |
| | 3 | 317 | 24 | 23.7 | 7 | 00 | 14.0 | 0.413 7468 | | 19 | 190 | 44 | 42.1 | 4 | 18 | 39.0 | 0.402 7545 |
| | 4 | 320 | 58 | 56.7 | 6 | 59 | 57.4 | 0.408 6470 | | 20 | 194 | 23 | 17.5 | 3 | 57 | 02.5 | 0.408 0367 |
| | 5 | 324 | 38 | 59.4 | 6 | 57 | 59.4 | 0.403 3830 | | 21 | 197 | 56 | 11.3 | 3 | 35 | 03.4 | 0.413 1566 |
| | 6 | 328 | 24 | 53.5 | 6 | 54 | 12.4 | 0.397 9719 | | 22 | 201 | 23 | 47.7 | 3 | 12 | 48.6 | 0.418 0986 |
| | 7 | 332 | 17 | 01.3 | -6 | 48 | 28.5 | 0.392 4331 | | 23 | 204 | 46 | 29.6 | +2 | 50 | 23.7 | 0.422 8489 |
| | 8 | 336 | 15 | 45.3 | 6 | 40 | 39.2 | 0.386 7883 | | 24 | 208 | 04 | 39.2 | 2 | 27 | 53.7 | 0.427 3954 |
| | 9 | 340 | 21 | 27.8 | 6 | 30 | 35.9 | 0.381 0615 | | 25 | 211 | 18 | 37.8 | 2 | 05 | 23.0 | 0.431 7271 |
| | 10 | 344 | 34 | 31.4 | 6 | 18 | 10.1 | 0.375 2798 | | 26 | 214 | 28 | 45.4 | 1 | 42 | 55.1 | 0.435 8347 |
| | 11 | 348 | 55 | 17.6 | 6 | 03 | 13.3 | 0.369 4728 | | 27 | 217 | 35 | 21.6 | 1 | 20 | 33.3 | 0.439 7097 |
| | 12 | 353 | 24 | 07.3 | 5 | 45 | 37.7 | 0.363 6734 | | 28 | 220 | 38 | 44.8 | 0 | 58 | 20.4 | 0.443 3446 |
| | 13 | 358 | 01 | 19.5 | -5 | 25 | 16.1 | 0.357 9178 | | 29 | 223 | 39 | 12.6 | +0 | 36 | 18.7 | 0.446 7330 |
| | 14 | 2 | 47 | 11.0 | 5 | 02 | 02.9 | 0.352 2451 | | 30 | 226 | 37 | 01.9 | +0 | 14 | 30.3 | 0.449 8692 |
| | 15 | 7 | 41 | 55.7 | 4 | 35 | 54.0 | 0.346 6978 | | 31 | 229 | 32 | 28.9 | -0 | 07 | 03.1 | 0.452 7482 |
| | 16 | 12 | 45 | 43.2 | 4 | 06 | 48.3 | 0.341 3213 | June | 1 | 232 | 25 | 49.0 | 0 | 28 | 19.7 | 0.455 3657 |
| | 17 | 17 | 58 | 38.5 | 3 | 34 | 47.5 | 0.336 1639 | | 2 | 235 | 17 | 17.3 | 0 | 49 | 18.3 | 0.457 7181 |
| | 18 | 23 | 20 | 40.2 | 2 | 59 | 57.4 | 0.331 2758 | | 3 | 238 | 07 | 08.1 | 1 | 09 | 57.5 | 0.459 8021 |
| | 19 | 28 | 51 | 39.8 | -2 | 22 | 28.4 | 0.326 7090 | | 4 | 240 | 55 | 35.3 | -1 | 30 | 16.1 | 0.461 6149 |
| | 20 | 34 | 31 | 20.5 | 1 | 42 | 36.1 | 0.322 5156 | | 5 | 243 | 42 | 52.4 | 1 | 50 | 13.0 | 0.463 1544 |
| | 21 | 40 | 19 | 16.1 | 1 | 00 | 42.0 | 0.318 7473 | | 6 | 246 | 29 | 12.6 | 2 | 09 | 47.2 | 0.464 4187 |
| | 22 | 46 | 14 | 50.3 | -0 | 17 | 13.2 | 0.315 4537 | | 7 | 249 | 14 | 48.7 | 2 | 28 | 57.6 | 0.465 4062 |
| | 23 | 52 | 17 | 16.3 | +0 | 27 | 17.4 | 0.312 6808 | | 8 | 251 | 59 | 53.4 | 2 | 47 | 43.3 | 0.466 1158 |
| | 24 | 58 | 25 | 36.4 | 1 | 12 | 12.2 | 0.310 4691 | | 9 | 254 | 44 | 39.1 | 3 | 06 | 03.1 | 0.466 5467 |
| | 25 | 64 | 38 | 43.2 | +1 | 56 | 49.7 | 0.308 8526 | | 10 | 257 | 29 | 18.0 | -3 | 23 | 55.9 | 0.466 6985 |
| | 26 | 70 | 55 | 19.9 | 2 | 40 | 26.3 | 0.307 8568 | | 11 | 260 | 14 | 02.5 | 3 | 41 | 20.8 | 0.466 5709 |
| | 27 | 77 | 14 | 02.6 | 3 | 22 | 18.3 | 0.307 4978 | | 12 | 262 | 59 | 04.7 | 3 | 58 | 16.3 | 0.466 1641 |
| | 28 | 83 | 33 | 22.6 | 4 | 01 | 43.8 | 0.307 7815 | | 13 | 265 | 44 | 36.8 | 4 | 14 | 41.2 | 0.465 4785 |
| | 29 | 89 | 51 | 48.6 | 4 | 38 | 04.9 | 0.308 7031 | | 14 | 268 | 30 | 51.2 | 4 | 30 | 34.1 | 0.464 5150 |
| | 30 | 96 | 07 | 50.6 | 5 | 10 | 49.8 | 0.310 2479 | | 15 | 271 | 18 | 00.1 | 4 | 45 | 53.5 | 0.463 2747 |
| May | 1 | 102 | 20 | 01.8 | +5 | 39 | 33.4 | 0.312 3913 | | 16 | 274 | 06 | 16.3 | -5 | 00 | 37.6 | 0.461 7589 |
| | 2 | 108 | 27 | 02.3 | 6 | 03 | 58.5 | 0.315 1003 | | 17 | 276 | 55 | 52.5 | 5 | 14 | 44.6 | 0.459 9696 |
| | 3 | 114 | 27 | 40.7 | 6 | 23 | 56.1 | 0.318 3350 | | 18 | 279 | 47 | 01.8 | 5 | 28 | 12.3 | 0.457 9090 |
| | 4 | 120 | 20 | 56.0 | 6 | 39 | 24.4 | 0.322 0501 | | 19 | 282 | 39 | 57.7 | 5 | 40 | 58.6 | 0.455 5798 |
| | 5 | 126 | 05 | 58.5 | 6 | 50 | 28.7 | 0.326 1962 | | 20 | 285 | 34 | 53.8 | 5 | 53 | 00.9 | 0.452 9850 |
| | 6 | 131 | 42 | 10.1 | 6 | 57 | 19.4 | 0.330 7219 | | 21 | 288 | 32 | 04.6 | 6 | 04 | 16.5 | 0.450 1285 |
| | 7 | 137 | 09 | 04.1 | +7 | 00 | 11.5 | 0.335 5749 | | 22 | 291 | 31 | 44.5 | -6 | 14 | 42.3 | 0.447 0144 |
| | 8 | 142 | 26 | 24.4 | 6 | 59 | 22.7 | 0.340 7033 | | 23 | 294 | 34 | 08.9 | 6 | 24 | 14.9 | 0.443 6477 |
| | 9 | 147 | 34 | 04.1 | 6 | 55 | 12.9 | 0.346 0565 | | 24 | 297 | 39 | 33.6 | 6 | 32 | 50.7 | 0.440 0339 |
| | 10 | 152 | 32 | 04.9 | 6 | 48 | 02.5 | 0.351 5862 | | 25 | 300 | 48 | 14.8 | 6 | 40 | 25.6 | 0.436 1795 |
| | 11 | 157 | 20 | 35.0 | 6 | 38 | 11.9 | 0.357 2464 | | 26 | 304 | 00 | 29.7 | 6 | 46 | 55.1 | 0.432 0918 |
| | 12 | 161 | 59 | 48.2 | 6 | 26 | 01.1 | 0.362 9944 | | 27 | 307 | 16 | 35.8 | 6 | 52 | 14.3 | 0.427 7791 |
| | 13 | 166 | 30 | 02.7 | +6 | 11 | 48.8 | 0.368 7905 | | 28 | 310 | 36 | 51.8 | -6 | 56 | 17.9 | 0.423 2509 |
| | 14 | 170 | 51 | 39.7 | 5 | 55 | 52.6 | 0.374 5983 | | 29 | 314 | 01 | 36.7 | 6 | 59 | 00.2 | 0.418 5178 |
| | 15 | 175 | 05 | 02.8 | 5 | 38 | 28.5 | 0.380 3846 | | 30 | 317 | 31 | 10.3 | 7 | 00 | 14.9 | 0.413 5920 |
| | 16 | 179 | 10 | 36.7 | 5 | 19 | 50.9 | 0.386 1193 | July | 1 | 321 | 05 | 53.1 | 6 | 59 | 55.2 | 0.408 4870 |
| | 17 | 183 | 08 | 47.3 | +5 | 00 | 12.6 | 0.391 7750 | | 2 | 324 | 46 | 06.3 | -6 | 57 | 54.0 | 0.403 2183 |

**MERCURY, 2021**
HELIOCENTRIC POSITIONS FOR $0^h$ TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

| Date | | Heliocentric Longitude | | | Heliocentric Latitude | | | Radius Vector | Date | | Heliocentric Longitude | | | Heliocentric Latitude | | | Radius Vector |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | | ° | ' | " | ° | ' | " | |
| July | 1 | 321 | 05 | 53.1 | -6 | 59 | 55.2 | 0.408 4870 | Aug. | 16 | 194 | 30 | 06.4 | +3 | 56 | 22.1 | 0.408 1953 |
| | 2 | 324 | 46 | 06.3 | 6 | 57 | 54.0 | 0.403 2183 | | 17 | 198 | 02 | 50.3 | 3 | 34 | 22.5 | 0.413 3099 |
| | 3 | 328 | 32 | 11.7 | 6 | 54 | 03.5 | 0.397 8032 | | 18 | 201 | 30 | 17.3 | 3 | 12 | 07.2 | 0.418 2461 |
| | 4 | 332 | 24 | 31.4 | 6 | 48 | 15.8 | 0.392 2609 | | 19 | 204 | 52 | 50.7 | 2 | 49 | 42.1 | 0.422 9903 |
| | 5 | 336 | 23 | 27.9 | 6 | 40 | 22.4 | 0.386 6133 | | 20 | 208 | 10 | 52.4 | 2 | 27 | 12.0 | 0.427 5303 |
| | 6 | 340 | 29 | 23.7 | 6 | 30 | 14.9 | 0.380 8846 | | 21 | 211 | 24 | 43.6 | 2 | 04 | 41.2 | 0.431 8553 |
| | 7 | 344 | 42 | 41.1 | -6 | 17 | 44.5 | 0.375 1018 | | 22 | 214 | 34 | 44.6 | +1 | 42 | 13.5 | 0.435 9558 |
| | 8 | 349 | 03 | 41.9 | 6 | 02 | 42.9 | 0.369 2948 | | 23 | 217 | 41 | 14.7 | 1 | 19 | 52.0 | 0.439 8235 |
| | 9 | 353 | 32 | 46.7 | 5 | 45 | 02.2 | 0.363 4964 | | 24 | 220 | 44 | 32.3 | 0 | 57 | 39.3 | 0.443 4509 |
| | 10 | 358 | 10 | 14.6 | 5 | 24 | 35.4 | 0.357 7429 | | 25 | 223 | 44 | 55.0 | 0 | 35 | 38.0 | 0.446 8316 |
| | 11 | 2 | 56 | 22.2 | 5 | 01 | 16.8 | 0.352 0735 | | 26 | 226 | 42 | 39.9 | +0 | 13 | 50.0 | 0.449 9600 |
| | 12 | 7 | 51 | 23.4 | 4 | 35 | 02.5 | 0.346 5310 | | 27 | 229 | 38 | 02.8 | -0 | 07 | 42.9 | 0.452 8310 |
| | 13 | 12 | 55 | 27.6 | -4 | 05 | 51.3 | 0.341 1607 | | 28 | 232 | 31 | 19.4 | -0 | 28 | 59.0 | 0.455 4405 |
| | 14 | 18 | 08 | 39.6 | 3 | 33 | 45.2 | 0.336 0110 | | 29 | 235 | 22 | 44.5 | 0 | 49 | 57.0 | 0.457 7847 |
| | 15 | 23 | 30 | 57.8 | 2 | 58 | 50.0 | 0.331 1322 | | 30 | 238 | 12 | 32.6 | 1 | 10 | 35.5 | 0.459 8604 |
| | 16 | 29 | 02 | 13.5 | 2 | 21 | 16.3 | 0.326 5762 | | 31 | 241 | 00 | 57.5 | 1 | 30 | 53.5 | 0.461 6650 |
| | 17 | 34 | 42 | 09.6 | 1 | 41 | 20.0 | 0.322 3953 | Sept. | 1 | 243 | 48 | 12.8 | 1 | 50 | 49.8 | 0.463 1961 |
| | 18 | 40 | 30 | 19.6 | 0 | 59 | 22.5 | 0.318 6410 | | 2 | 246 | 34 | 31.5 | 2 | 10 | 23.2 | 0.464 4519 |
| | 19 | 46 | 26 | 07.0 | -0 | 15 | 51.4 | 0.315 3629 | | 3 | 249 | 20 | 06.6 | -2 | 29 | 32.9 | 0.465 4310 |
| | 20 | 52 | 28 | 44.4 | +0 | 28 | 40.6 | 0.312 6067 | | 4 | 252 | 05 | 10.6 | 2 | 48 | 17.8 | 0.466 1321 |
| | 21 | 58 | 37 | 14.2 | 1 | 13 | 35.4 | 0.310 4129 | | 5 | 254 | 49 | 55.9 | 3 | 06 | 36.8 | 0.466 5545 |
| | 22 | 64 | 50 | 28.2 | 1 | 58 | 11.6 | 0.308 8151 | | 6 | 257 | 34 | 35.0 | 3 | 24 | 28.8 | 0.466 6978 |
| | 23 | 71 | 07 | 09.8 | 2 | 41 | 45.6 | 0.307 8387 | | 7 | 260 | 19 | 19.9 | 3 | 41 | 52.7 | 0.466 5617 |
| | 24 | 77 | 25 | 54.7 | 3 | 23 | 33.6 | 0.307 4994 | | 8 | 263 | 04 | 22.9 | 3 | 58 | 47.3 | 0.466 1465 |
| | 25 | 83 | 45 | 14.0 | +4 | 02 | 53.9 | 0.307 8027 | | 9 | 265 | 49 | 56.2 | -4 | 15 | 11.3 | 0.465 4525 |
| | 26 | 90 | 03 | 36.7 | 4 | 39 | 08.9 | 0.308 7436 | | 10 | 268 | 36 | 12.1 | 4 | 31 | 03.2 | 0.464 4806 |
| | 27 | 96 | 19 | 32.5 | 5 | 11 | 46.6 | 0.310 3071 | | 11 | 271 | 23 | 23.0 | 4 | 46 | 21.5 | 0.463 2320 |
| | 28 | 102 | 31 | 35.1 | 5 | 40 | 22.4 | 0.312 4682 | | 12 | 274 | 11 | 41.4 | 5 | 01 | 04.5 | 0.461 7080 |
| | 29 | 108 | 38 | 24.7 | 6 | 04 | 39.4 | 0.315 1938 | | 13 | 277 | 01 | 20.3 | 5 | 15 | 10.2 | 0.459 9105 |
| | 30 | 114 | 38 | 50.2 | 6 | 24 | 28.6 | 0.318 4438 | | 14 | 279 | 52 | 32.8 | 5 | 28 | 36.7 | 0.457 8418 |
| | 31 | 120 | 31 | 50.8 | +6 | 39 | 48.8 | 0.322 1727 | | 15 | 282 | 45 | 32.1 | -5 | 41 | 21.7 | 0.455 5045 |
| Aug. | 1 | 126 | 16 | 37.3 | 6 | 50 | 45.0 | 0.326 3310 | | 16 | 285 | 40 | 32.3 | 5 | 53 | 22.6 | 0.452 9019 |
| | 2 | 131 | 52 | 32.1 | 6 | 57 | 28.1 | 0.330 8673 | | 17 | 288 | 37 | 47.3 | 6 | 04 | 36.7 | 0.450 0376 |
| | 3 | 137 | 19 | 08.6 | 7 | 00 | 13.1 | 0.335 7294 | | 18 | 291 | 37 | 32.1 | 6 | 15 | 00.9 | 0.446 9159 |
| | 4 | 142 | 36 | 11.0 | 6 | 59 | 17.9 | 0.340 8652 | | 19 | 294 | 40 | 01.8 | 6 | 24 | 31.7 | 0.443 5418 |
| | 5 | 147 | 43 | 32.9 | 6 | 55 | 02.2 | 0.346 2244 | | 20 | 297 | 45 | 32.2 | 6 | 33 | 05.7 | 0.439 9208 |
| | 6 | 152 | 41 | 16.0 | +6 | 47 | 46.6 | 0.351 7585 | | 21 | 300 | 54 | 19.7 | -6 | 40 | 38.6 | 0.436 0594 |
| | 7 | 157 | 29 | 28.7 | 6 | 37 | 51.4 | 0.357 4219 | | 22 | 304 | 06 | 41.3 | 6 | 47 | 05.9 | 0.431 9649 |
| | 8 | 162 | 08 | 25.2 | 6 | 25 | 36.6 | 0.363 1718 | | 23 | 307 | 22 | 54.8 | 6 | 52 | 22.9 | 0.427 6458 |
| | 9 | 166 | 38 | 23.5 | 6 | 11 | 20.9 | 0.368 9686 | | 24 | 310 | 43 | 18.6 | 6 | 56 | 24.1 | 0.423 1114 |
| | 10 | 170 | 59 | 45.1 | 5 | 55 | 21.7 | 0.374 7761 | | 25 | 314 | 08 | 11.9 | 6 | 59 | 03.7 | 0.418 3726 |
| | 11 | 175 | 12 | 53.4 | 5 | 37 | 55.1 | 0.380 5611 | | 26 | 317 | 37 | 54.5 | 7 | 00 | 15.6 | 0.413 4414 |
| | 12 | 179 | 18 | 13.4 | +5 | 19 | 15.4 | 0.386 2936 | | 27 | 321 | 12 | 47.0 | -6 | 59 | 52.8 | 0.408 3314 |
| | 13 | 183 | 16 | 10.9 | 4 | 59 | 35.5 | 0.391 9464 | | 28 | 324 | 53 | 10.5 | 6 | 57 | 48.3 | 0.403 0583 |
| | 14 | 187 | 07 | 11.7 | 4 | 39 | 06.8 | 0.397 4951 | | 29 | 328 | 39 | 26.7 | 6 | 53 | 54.4 | 0.397 6392 |
| | 15 | 190 | 51 | 41.8 | 4 | 17 | 59.4 | 0.402 9179 | | 30 | 332 | 31 | 58.0 | 6 | 48 | 02.9 | 0.392 0937 |
| | 16 | 194 | 30 | 06.4 | +3 | 56 | 22.1 | 0.408 1953 | Oct. | 1 | 336 | 31 | 06.7 | -6 | 40 | 05.5 | 0.386 4436 |

**MERCURY, 2021**
HELIOCENTRIC POSITIONS FOR $0^h$ TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

| Date | Heliocentric Longitude | Heliocentric Latitude | Radius Vector | Date | Heliocentric Longitude | Heliocentric Latitude | Radius Vector |
|---|---|---|---|---|---|---|---|
| | ° ' " | ° ' " | | | ° ' " | ° ' " | |
| Oct. 1 | 336 31 06.7 | -6 40 05.5 | 0.386 4436 | Nov. 16 | 208 16 59.5 | +2 26 30.7 | 0.427 6607 |
| 2 | 340 37 15.4 | 6 29 53.7 | 0.380 7131 | 17 | 211 30 43.7 | 2 03 59.9 | 0.431 9790 |
| 3 | 344 50 46.3 | 6 17 18.8 | 0.374 9294 | 18 | 214 40 38.3 | 1 41 32.3 | 0.436 0726 |
| 4 | 349 12 01.2 | 6 02 12.4 | 0.369 1224 | 19 | 217 47 02.5 | 1 19 11.0 | 0.439 9331 |
| 5 | 353 41 20.8 | 5 44 26.8 | 0.363 3251 | 20 | 220 50 14.8 | 0 56 58.7 | 0.443 5533 |
| 6 | 358 19 03.8 | 5 23 54.8 | 0.357 5737 | 21 | 223 50 32.7 | 0 34 57.7 | 0.446 9265 |
| 7 | 3 05 27.1 | -5 00 30.8 | 0.351 9079 | 22 | 226 48 13.2 | +0 13 10.0 | 0.450 0472 |
| 8 | 8 00 44.2 | 4 34 11.2 | 0.346 3700 | 23 | 229 43 32.2 | -0 08 22.3 | 0.452 9105 |
| 9 | 13 05 04.5 | 4 04 54.7 | 0.341 0060 | 24 | 232 36 45.4 | 0 29 37.9 | 0.455 5121 |
| 10 | 18 18 32.6 | 3 32 43.3 | 0.335 8639 | 25 | 235 28 07.6 | 0 50 35.4 | 0.457 8483 |
| 11 | 23 41 06.7 | 2 57 43.2 | 0.330 9943 | 26 | 238 17 53.1 | 1 11 13.3 | 0.459 9160 |
| 12 | 29 12 37.9 | 2 20 05.0 | 0.326 4489 | 27 | 241 06 15.9 | 1 31 30.7 | 0.461 7124 |
| 13 | 34 52 48.8 | -1 40 04.7 | 0.322 2802 | 28 | 243 53 29.3 | -1 51 26.2 | 0.463 2353 |
| 14 | 40 41 12.7 | 0 58 04.0 | 0.318 5397 | 29 | 246 39 46.7 | 2 10 59.0 | 0.464 4829 |
| 15 | 46 37 12.6 | -0 14 30.6 | 0.315 2767 | 30 | 249 25 20.8 | 2 30 08.0 | 0.465 4537 |
| 16 | 52 40 00.9 | +0 30 02.5 | 0.312 5368 | Dec. 1 | 252 10 24.1 | 2 48 52.0 | 0.466 1466 |
| 17 | 58 48 39.7 | 1 14 57.3 | 0.310 3605 | 2 | 254 55 09.2 | 3 07 10.3 | 0.466 5607 |
| 18 | 65 02 00.6 | 1 59 32.2 | 0.308 7810 | 3 | 257 39 48.4 | 3 25 01.4 | 0.466 6956 |
| 19 | 71 18 46.5 | +2 43 03.5 | 0.307 8235 | 4 | 260 24 33.7 | -3 42 24.5 | 0.466 5512 |
| 20 | 77 37 33.2 | 3 24 47.5 | 0.307 5033 | 5 | 263 09 37.5 | 3 59 18.2 | 0.466 1277 |
| 21 | 83 56 51.6 | 4 04 02.7 | 0.307 8256 | 6 | 265 55 12.0 | 4 15 41.2 | 0.465 4254 |
| 22 | 90 15 10.7 | 4 40 11.4 | 0.308 7853 | 7 | 268 41 29.5 | 4 31 32.0 | 0.464 4452 |
| 23 | 96 31 00.3 | 5 12 42.1 | 0.310 3668 | 8 | 271 28 42.3 | 4 46 49.3 | 0.463 1883 |
| 24 | 102 42 54.3 | 5 41 10.2 | 0.312 5451 | 9 | 274 17 03.0 | 5 01 31.1 | 0.461 6561 |
| 25 | 108 49 33.0 | +6 05 19.2 | 0.315 2868 | 10 | 277 06 44.6 | -5 15 35.7 | 0.459 8504 |
| 26 | 114 49 45.6 | 6 25 00.2 | 0.318 5515 | 11 | 279 58 00.1 | 5 29 01.0 | 0.457 7736 |
| 27 | 120 42 31.9 | 6 40 12.3 | 0.322 2936 | 12 | 282 51 03.0 | 5 41 44.6 | 0.455 4284 |
| 28 | 126 27 02.7 | 6 51 00.7 | 0.326 4637 | 13 | 285 46 07.1 | 5 53 44.1 | 0.452 8179 |
| 29 | 132 02 40.9 | 6 57 36.4 | 0.331 0102 | 14 | 288 43 26.5 | 6 04 56.7 | 0.449 9458 |
| 30 | 137 29 00.3 | 7 00 14.4 | 0.335 8808 | 15 | 291 43 16.1 | 6 15 19.3 | 0.446 8164 |
| 31 | 142 45 45.3 | +6 59 12.9 | 0.341 0237 | 16 | 294 45 51.0 | -6 24 48.5 | 0.443 4347 |
| Nov. 1 | 147 52 49.8 | 6 54 51.5 | 0.346 3885 | 17 | 297 51 27.2 | 6 33 20.6 | 0.439 8064 |
| 2 | 152 50 15.6 | 6 47 30.7 | 0.351 9268 | 18 | 301 00 20.9 | 6 40 51.5 | 0.435 9378 |
| 3 | 157 38 11.5 | 6 37 31.0 | 0.357 5931 | 19 | 304 12 49.3 | 6 47 16.8 | 0.431 8365 |
| 4 | 162 16 51.6 | 6 25 12.2 | 0.363 3446 | 20 | 307 29 10.2 | 6 52 31.5 | 0.427 5107 |
| 5 | 166 46 34.2 | 6 10 53.1 | 0.369 1420 | 21 | 310 49 41.9 | 6 56 30.3 | 0.422 9700 |
| 6 | 171 07 40.8 | +5 54 51.1 | 0.374 9490 | 22 | 314 14 43.7 | -6 59 07.4 | 0.418 2251 |
| 7 | 175 20 34.8 | 5 37 22.0 | 0.380 7326 | 23 | 317 44 35.4 | 7 00 16.4 | 0.413 2882 |
| 8 | 179 25 41.3 | 5 18 40.3 | 0.386 4629 | 24 | 321 19 37.6 | 6 59 50.7 | 0.408 1731 |
| 9 | 183 23 26.1 | 4 58 58.8 | 0.392 1127 | 25 | 325 00 11.5 | 6 57 42.9 | 0.402 8953 |
| 10 | 187 14 15.0 | 4 38 28.8 | 0.397 6578 | 26 | 328 46 38.9 | 6 53 45.5 | 0.397 4721 |
| 11 | 190 58 33.9 | 4 17 20.3 | 0.403 0764 | 27 | 332 39 21.9 | 6 47 50.3 | 0.391 9231 |
| 12 | 194 36 48.1 | +3 55 42.1 | 0.408 3490 | 28 | 336 38 43.1 | -6 39 48.9 | 0.386 2701 |
| 13 | 198 09 22.3 | 3 33 41.9 | 0.413 4583 | 29 | 340 45 04.9 | 6 29 32.8 | 0.380 5376 |
| 14 | 201 36 40.4 | 3 11 26.3 | 0.418 3889 | 30 | 344 58 49.6 | 6 16 53.4 | 0.374 7527 |
| 15 | 204 59 05.5 | 2 49 00.9 | 0.423 1271 | 31 | 349 20 19.0 | 6 01 42.3 | 0.368 9454 |
| 16 | 208 16 59.5 | +2 26 30.7 | 0.427 6607 | 32 | 353 49 53.5 | -5 43 51.7 | 0.363 1489 |

**MERCURY, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| Jan. | 0 | 286 | 05 | 16.4 | -2 | 04 | 36.5 | Feb. | 15 | 313 | 16 | 24.5 | +3 | 19 | 52.4 |
| | 1 | 287 | 42 | 49.5 | 2 | 06 | 12.9 | | 16 | 312 | 34 | 46.1 | 3 | 10 | 31.1 |
| | 2 | 289 | 20 | 36.8 | 2 | 07 | 26.4 | | 17 | 312 | 00 | 47.8 | 3 | 00 | 03.7 |
| | 3 | 290 | 58 | 37.2 | 2 | 08 | 15.9 | | 18 | 311 | 34 | 35.9 | 2 | 48 | 44.1 |
| | 4 | 292 | 36 | 49.1 | 2 | 08 | 40.1 | | 19 | 311 | 16 | 06.5 | 2 | 36 | 44.9 |
| | 5 | 294 | 15 | 10.5 | 2 | 08 | 37.7 | | 20 | 311 | 05 | 07.8 | 2 | 24 | 17.4 |
| | 6 | 295 | 53 | 38.9 | -2 | 08 | 07.3 | | 21 | 311 | 01 | 22.5 | +2 | 11 | 31.3 |
| | 7 | 297 | 32 | 11.0 | 2 | 07 | 07.4 | | 22 | 311 | 04 | 29.9 | 1 | 58 | 34.6 |
| | 8 | 299 | 10 | 42.6 | 2 | 05 | 36.4 | | 23 | 311 | 14 | 06.9 | 1 | 45 | 34.4 |
| | 9 | 300 | 49 | 08.6 | 2 | 03 | 32.7 | | 24 | 311 | 29 | 49.7 | 1 | 32 | 36.2 |
| | 10 | 302 | 27 | 22.8 | 2 | 00 | 54.5 | | 25 | 311 | 51 | 14.0 | 1 | 19 | 44.8 |
| | 11 | 304 | 05 | 17.7 | 1 | 57 | 40.1 | | 26 | 312 | 17 | 56.5 | 1 | 07 | 03.9 |
| | 12 | 305 | 42 | 44.1 | -1 | 53 | 47.3 | | 27 | 312 | 49 | 34.6 | +0 | 54 | 36.5 |
| | 13 | 307 | 19 | 31.2 | 1 | 49 | 14.4 | | 28 | 313 | 25 | 47.1 | 0 | 42 | 25.1 |
| | 14 | 308 | 55 | 26.2 | 1 | 43 | 59.3 | Mar. | 1 | 314 | 06 | 14.1 | 0 | 30 | 31.6 |
| | 15 | 310 | 30 | 13.9 | 1 | 37 | 59.9 | | 2 | 314 | 50 | 37.2 | +0 | 18 | 57.6 |
| | 16 | 312 | 03 | 36.7 | 1 | 31 | 14.2 | | 3 | 315 | 38 | 39.5 | -0 | 07 | 44.2 |
| | 17 | 313 | 35 | 14.0 | 1 | 23 | 40.2 | | 4 | 316 | 30 | 05.6 | 0 | 03 | 07.6 |
| | 18 | 315 | 04 | 42.2 | -1 | 15 | 16.0 | | 5 | 317 | 24 | 41.2 | -0 | 13 | 37.1 |
| | 19 | 316 | 31 | 33.9 | 1 | 05 | 59.9 | | 6 | 318 | 22 | 13.6 | 0 | 23 | 43.7 |
| | 20 | 317 | 55 | 18.3 | 0 | 55 | 50.5 | | 7 | 319 | 22 | 30.9 | 0 | 33 | 26.9 |
| | 21 | 319 | 15 | 20.5 | 0 | 44 | 46.8 | | 8 | 320 | 25 | 22.8 | 0 | 42 | 46.3 |
| | 22 | 320 | 31 | 01.8 | 0 | 32 | 48.2 | | 9 | 321 | 30 | 39.7 | 0 | 51 | 41.8 |
| | 23 | 321 | 41 | 39.4 | 0 | 19 | 54.8 | | 10 | 322 | 38 | 13.1 | 1 | 00 | 13.0 |
| | 24 | 322 | 46 | 27.6 | -0 | 06 | 07.9 | | 11 | 323 | 47 | 55.3 | -1 | 08 | 19.7 |
| | 25 | 323 | 44 | 37.4 | +0 | 08 | 30.5 | | 12 | 324 | 59 | 39.7 | 1 | 16 | 01.9 |
| | 26 | 324 | 35 | 18.5 | 0 | 23 | 57.0 | | 13 | 326 | 13 | 20.0 | 1 | 23 | 19.3 |
| | 27 | 325 | 17 | 40.1 | 0 | 40 | 06.3 | | 14 | 327 | 28 | 51.1 | 1 | 30 | 11.8 |
| | 28 | 325 | 50 | 53.3 | 0 | 56 | 51.6 | | 15 | 328 | 46 | 08.1 | 1 | 36 | 39.2 |
| | 29 | 326 | 14 | 12.9 | 1 | 14 | 03.9 | | 16 | 330 | 05 | 06.9 | 1 | 42 | 41.5 |
| | 30 | 326 | 27 | 00.8 | +1 | 31 | 32.0 | | 17 | 331 | 25 | 43.9 | -1 | 48 | 18.5 |
| | 31 | 326 | 28 | 48.8 | 1 | 49 | 02.3 | | 18 | 332 | 47 | 55.8 | 1 | 53 | 30.0 |
| Feb. | 1 | 326 | 19 | 21.8 | 2 | 06 | 19.1 | | 19 | 334 | 11 | 40.0 | 1 | 58 | 15.8 |
| | 2 | 325 | 58 | 41.3 | 2 | 23 | 04.5 | | 20 | 335 | 36 | 54.1 | 2 | 02 | 35.8 |
| | 3 | 325 | 27 | 07.5 | 2 | 38 | 59.1 | | 21 | 337 | 03 | 36.0 | 2 | 06 | 29.9 |
| | 4 | 324 | 45 | 21.9 | 2 | 53 | 42.7 | | 22 | 338 | 31 | 44.1 | 2 | 09 | 57.7 |
| | 5 | 323 | 54 | 27.1 | +3 | 06 | 55.6 | | 23 | 340 | 01 | 17.1 | -2 | 12 | 59.0 |
| | 6 | 322 | 55 | 46.0 | 3 | 18 | 19.2 | | 24 | 341 | 32 | 13.9 | 2 | 15 | 33.8 |
| | 7 | 321 | 50 | 58.7 | 3 | 27 | 37.8 | | 25 | 343 | 04 | 33.7 | 2 | 17 | 41.6 |
| | 8 | 320 | 41 | 58.0 | 3 | 34 | 39.4 | | 26 | 344 | 38 | 15.8 | 2 | 19 | 22.2 |
| | 9 | 319 | 30 | 43.2 | 3 | 39 | 17.0 | | 27 | 346 | 13 | 20.0 | 2 | 20 | 35.4 |
| | 10 | 318 | 19 | 14.0 | 3 | 41 | 28.4 | | 28 | 347 | 49 | 46.2 | 2 | 21 | 20.9 |
| | 11 | 317 | 09 | 23.5 | +3 | 41 | 16.5 | | 29 | 349 | 27 | 34.5 | -2 | 21 | 38.5 |
| | 12 | 316 | 02 | 53.7 | 3 | 38 | 48.8 | | 30 | 351 | 06 | 45.0 | 2 | 21 | 27.7 |
| | 13 | 315 | 01 | 10.9 | 3 | 34 | 16.3 | | 31 | 352 | 47 | 18.2 | 2 | 20 | 48.3 |
| | 14 | 314 | 05 | 24.1 | 3 | 27 | 52.5 | Apr. | 1 | 354 | 29 | 14.7 | 2 | 19 | 40.1 |
| | 15 | 313 | 16 | 24.5 | +3 | 19 | 52.4 | | 2 | 356 | 12 | 34.8 | -2 | 18 | 02.7 |

**MERCURY, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| Apr. | 1 | 354 | 29 | 14.7 | -2 | 19 | 40.1 | May | 17 | 78 | 13 | 11.8 | +2 | 20 | 09.2 |
| | 2 | 356 | 12 | 34.8 | 2 | 18 | 02.7 | | 18 | 79 | 10 | 21.0 | 2 | 15 | 48.2 |
| | 3 | 357 | 57 | 19.3 | 2 | 15 | 55.9 | | 19 | 80 | 03 | 11.2 | 2 | 10 | 29.3 |
| | 4 | 359 | 43 | 28.8 | 2 | 13 | 19.3 | | 20 | 80 | 51 | 38.4 | 2 | 04 | 12.4 |
| | 5 | 1 | 31 | 03.7 | 2 | 10 | 12.9 | | 21 | 81 | 35 | 38.6 | 1 | 56 | 57.5 |
| | 6 | 3 | 20 | 04.9 | 2 | 06 | 36.3 | | 22 | 82 | 15 | 07.9 | 1 | 48 | 44.8 |
| | 7 | 5 | 10 | 32.6 | -2 | 02 | 29.4 | | 23 | 82 | 50 | 02.3 | +1 | 39 | 34.8 |
| | 8 | 7 | 02 | 27.4 | 1 | 57 | 52.1 | | 24 | 83 | 20 | 18.6 | 1 | 29 | 28.2 |
| | 9 | 8 | 55 | 49.4 | 1 | 52 | 44.4 | | 25 | 83 | 45 | 53.9 | 1 | 18 | 26.1 |
| | 10 | 10 | 50 | 38.4 | 1 | 47 | 06.3 | | 26 | 84 | 06 | 46.1 | 1 | 06 | 30.0 |
| | 11 | 12 | 46 | 54.2 | 1 | 40 | 58.1 | | 27 | 84 | 22 | 54.1 | 0 | 53 | 42.0 |
| | 12 | 14 | 44 | 35.6 | 1 | 34 | 20.0 | | 28 | 84 | 34 | 17.8 | 0 | 40 | 04.4 |
| | 13 | 16 | 43 | 41.3 | -1 | 27 | 12.4 | | 29 | 84 | 40 | 58.9 | +0 | 25 | 40.4 |
| | 14 | 18 | 44 | 09.0 | 1 | 19 | 36.1 | | 30 | 84 | 43 | 00.8 | -0 | 10 | 33.7 |
| | 15 | 20 | 45 | 55.7 | 1 | 11 | 31.8 | | 31 | 84 | 40 | 28.8 | 0 | 05 | 11.1 |
| | 16 | 22 | 48 | 57.2 | -1 | 03 | 00.7 | June | 1 | 84 | 33 | 31.0 | 0 | 21 | 28.9 |
| | 17 | 24 | 53 | 08.3 | +0 | 54 | 04.2 | | 2 | 84 | 22 | 17.7 | 0 | 38 | 13.7 |
| | 18 | 26 | 58 | 22.4 | 0 | 44 | 44.0 | | 3 | 84 | 07 | 02.4 | 0 | 55 | 18.8 |
| | 19 | 29 | 04 | 31.6 | +0 | 35 | 02.2 | | 4 | 83 | 48 | 01.6 | -1 | 12 | 36.6 |
| | 20 | 31 | 11 | 26.3 | 0 | 25 | 00.9 | | 5 | 83 | 25 | 34.7 | 1 | 29 | 59.0 |
| | 21 | 33 | 18 | 55.1 | 0 | 14 | 43.2 | | 6 | 83 | 00 | 04.5 | 1 | 47 | 17.4 |
| | 22 | 35 | 26 | 45.3 | -0 | 04 | 12.3 | | 7 | 82 | 31 | 56.5 | 2 | 04 | 22.7 |
| | 23 | 37 | 34 | 42.6 | +0 | 06 | 28.3 | | 8 | 82 | 01 | 39.2 | 2 | 21 | 05.6 |
| | 24 | 39 | 42 | 31.0 | 0 | 17 | 14.6 | | 9 | 81 | 29 | 43.2 | 2 | 37 | 16.8 |
| | 25 | 41 | 49 | 53.4 | +0 | 28 | 02.5 | | 10 | 80 | 56 | 41.1 | -2 | 52 | 47.2 |
| | 26 | 43 | 56 | 31.9 | 0 | 38 | 47.4 | | 11 | 80 | 23 | 06.7 | 3 | 07 | 28.2 |
| | 27 | 46 | 02 | 07.9 | 0 | 49 | 24.7 | | 12 | 79 | 49 | 34.5 | 3 | 21 | 11.8 |
| | 28 | 48 | 06 | 22.7 | 0 | 59 | 49.7 | | 13 | 79 | 16 | 39.0 | 3 | 33 | 50.9 |
| | 29 | 50 | 08 | 57.8 | 1 | 09 | 57.7 | | 14 | 78 | 44 | 53.8 | 3 | 45 | 19.3 |
| | 30 | 52 | 09 | 35.3 | 1 | 19 | 44.2 | | 15 | 78 | 14 | 51.3 | 3 | 55 | 31.9 |
| May | 1 | 54 | 07 | 58.3 | +1 | 29 | 04.8 | | 16 | 77 | 47 | 02.0 | -4 | 04 | 25.1 |
| | 2 | 56 | 03 | 51.1 | 1 | 37 | 55.2 | | 17 | 77 | 21 | 53.8 | 4 | 11 | 56.1 |
| | 3 | 57 | 56 | 59.5 | 1 | 46 | 11.9 | | 18 | 76 | 59 | 52.2 | 4 | 18 | 03.4 |
| | 4 | 59 | 47 | 10.9 | 1 | 53 | 51.2 | | 19 | 76 | 41 | 19.4 | 4 | 22 | 46.6 |
| | 5 | 61 | 34 | 14.1 | 2 | 00 | 50.1 | | 20 | 76 | 26 | 34.9 | 4 | 26 | 06.4 |
| | 6 | 63 | 17 | 59.8 | 2 | 07 | 05.8 | | 21 | 76 | 15 | 54.8 | 4 | 28 | 04.1 |
| | 7 | 64 | 58 | 19.5 | +2 | 12 | 36.0 | | 22 | 76 | 09 | 32.4 | -4 | 28 | 42.1 |
| | 8 | 66 | 35 | 06.4 | 2 | 17 | 18.6 | | 23 | 76 | 07 | 38.3 | 4 | 28 | 03.0 |
| | 9 | 68 | 08 | 14.5 | 2 | 21 | 11.7 | | 24 | 76 | 10 | 20.2 | 4 | 26 | 10.1 |
| | 10 | 69 | 37 | 38.5 | 2 | 24 | 13.8 | | 25 | 76 | 17 | 43.7 | 4 | 23 | 07.0 |
| | 11 | 71 | 03 | 14.1 | 2 | 26 | 23.6 | | 26 | 76 | 29 | 52.3 | 4 | 18 | 57.7 |
| | 12 | 72 | 24 | 57.0 | 2 | 27 | 40.0 | | 27 | 76 | 46 | 47.7 | 4 | 13 | 45.9 |
| | 13 | 73 | 42 | 43.4 | +2 | 28 | 01.8 | | 28 | 77 | 08 | 30.3 | -4 | 07 | 35.9 |
| | 14 | 74 | 56 | 29.8 | 2 | 27 | 28.3 | | 29 | 77 | 34 | 59.2 | 4 | 00 | 31.6 |
| | 15 | 76 | 06 | 12.4 | 2 | 25 | 58.8 | | 30 | 78 | 06 | 12.6 | 3 | 52 | 37.0 |
| | 16 | 77 | 11 | 47.7 | 2 | 23 | 32.6 | July | 1 | 78 | 42 | 08.3 | 3 | 43 | 56.2 |
| | 17 | 78 | 13 | 11.8 | +2 | 20 | 09.2 | | 2 | 79 | 22 | 43.2 | -3 | 34 | 33.0 |

**MERCURY, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| July | 1 | 78 | 42 | 08.3 | -3 | 43 | 56.2 | Aug. | 16 | 157 | 23 | 26.1 | +1 | 13 | 46.9 |
| | 2 | 79 | 22 | 43.2 | 3 | 34 | 33.0 | | 17 | 159 | 08 | 13.8 | 1 | 08 | 09.3 |
| | 3 | 80 | 07 | 54.2 | 3 | 24 | 31.1 | | 18 | 160 | 51 | 34.0 | 1 | 02 | 11.9 |
| | 4 | 80 | 57 | 37.9 | 3 | 13 | 54.2 | | 19 | 162 | 33 | 27.6 | 0 | 55 | 56.0 |
| | 5 | 81 | 51 | 50.9 | 3 | 02 | 45.8 | | 20 | 164 | 13 | 55.1 | 0 | 49 | 22.9 |
| | 6 | 82 | 50 | 29.6 | 2 | 51 | 09.5 | | 21 | 165 | 52 | 57.4 | 0 | 42 | 33.8 |
| | 7 | 83 | 53 | 30.6 | -2 | 39 | 08.8 | | 22 | 167 | 30 | 35.1 | +0 | 35 | 30.0 |
| | 8 | 85 | 00 | 50.5 | 2 | 26 | 46.9 | | 23 | 169 | 06 | 48.7 | 0 | 28 | 12.7 |
| | 9 | 86 | 12 | 25.7 | 2 | 14 | 07.3 | | 24 | 170 | 41 | 38.8 | 0 | 20 | 42.9 |
| | 10 | 87 | 28 | 12.8 | 2 | 01 | 13.5 | | 25 | 172 | 15 | 05.6 | 0 | 13 | 01.7 |
| | 11 | 88 | 48 | 07.9 | 1 | 48 | 08.8 | | 26 | 173 | 47 | 09.4 | +0 | 05 | 10.1 |
| | 12 | 90 | 12 | 07.2 | 1 | 34 | 56.9 | | 27 | 175 | 17 | 50.1 | -0 | 02 | 50.8 |
| | 13 | 91 | 40 | 05.9 | -1 | 21 | 41.1 | | 28 | 176 | 47 | 07.5 | -0 | 11 | 00.1 |
| | 14 | 93 | 11 | 59.2 | 1 | 08 | 25.4 | | 29 | 178 | 15 | 01.0 | 0 | 19 | 16.9 |
| | 15 | 94 | 47 | 41.1 | 0 | 55 | 13.4 | | 30 | 179 | 41 | 30.0 | 0 | 27 | 40.2 |
| | 16 | 96 | 27 | 04.6 | 0 | 42 | 09.2 | | 31 | 181 | 06 | 33.5 | 0 | 36 | 09.0 |
| | 17 | 98 | 10 | 01.5 | 0 | 29 | 16.6 | Sept. | 1 | 182 | 30 | 10.1 | 0 | 44 | 42.5 |
| | 18 | 99 | 56 | 22.4 | -0 | 16 | 39.7 | | 2 | 183 | 52 | 18.1 | 0 | 53 | 19.9 |
| | 19 | 101 | 45 | 56.1 | +0 | 04 | 22.7 | | 3 | 185 | 12 | 55.7 | -1 | 02 | 00.0 |
| | 20 | 103 | 38 | 29.8 | 0 | 07 | 30.3 | | 4 | 186 | 32 | 00.3 | 1 | 10 | 42.1 |
| | 21 | 105 | 33 | 49.1 | 0 | 18 | 55.4 | | 5 | 187 | 49 | 29.3 | 1 | 19 | 25.2 |
| | 22 | 107 | 31 | 38.0 | 0 | 29 | 48.7 | | 6 | 189 | 05 | 19.3 | 1 | 28 | 08.3 |
| | 23 | 109 | 31 | 38.9 | 0 | 40 | 06.7 | | 7 | 190 | 19 | 26.5 | 1 | 36 | 50.4 |
| | 24 | 111 | 33 | 33.4 | 0 | 49 | 46.0 | | 8 | 191 | 31 | 46.7 | 1 | 45 | 30.5 |
| | 25 | 113 | 37 | 02.1 | +0 | 58 | 43.9 | | 9 | 192 | 42 | 14.9 | -1 | 54 | 07.5 |
| | 26 | 115 | 41 | 45.3 | 1 | 06 | 57.8 | | 10 | 193 | 50 | 45.6 | 2 | 02 | 40.1 |
| | 27 | 117 | 47 | 23.2 | 1 | 14 | 26.0 | | 11 | 194 | 57 | 12.5 | 2 | 11 | 07.2 |
| | 28 | 119 | 53 | 36.9 | 1 | 21 | 07.0 | | 12 | 196 | 01 | 28.5 | 2 | 19 | 27.4 |
| | 29 | 122 | 00 | 07.9 | 1 | 27 | 00.0 | | 13 | 197 | 03 | 25.7 | 2 | 27 | 39.1 |
| | 30 | 124 | 06 | 39.2 | 1 | 32 | 04.7 | | 14 | 198 | 02 | 55.0 | 2 | 35 | 40.9 |
| | 31 | 126 | 12 | 55.3 | +1 | 36 | 21.2 | | 15 | 198 | 59 | 46.6 | -2 | 43 | 30.8 |
| Aug. | 1 | 128 | 18 | 42.0 | 1 | 39 | 50.1 | | 16 | 199 | 53 | 49.3 | 2 | 51 | 07.1 |
| | 2 | 130 | 23 | 47.2 | 1 | 42 | 32.2 | | 17 | 200 | 44 | 51.1 | 2 | 58 | 27.3 |
| | 3 | 132 | 28 | 00.1 | 1 | 44 | 28.8 | | 18 | 201 | 32 | 38.3 | 3 | 05 | 29.3 |
| | 4 | 134 | 31 | 11.8 | 1 | 45 | 41.3 | | 19 | 202 | 16 | 56.2 | 3 | 12 | 10.2 |
| | 5 | 136 | 33 | 14.8 | 1 | 46 | 11.4 | | 20 | 202 | 57 | 28.4 | 3 | 18 | 27.0 |
| | 6 | 138 | 34 | 03.2 | +1 | 46 | 00.9 | | 21 | 203 | 33 | 57.3 | -3 | 24 | 16.4 |
| | 7 | 140 | 33 | 32.1 | 1 | 45 | 11.5 | | 22 | 204 | 06 | 03.7 | 3 | 29 | 34.4 |
| | 8 | 142 | 31 | 38.0 | 1 | 43 | 45.2 | | 23 | 204 | 33 | 26.9 | 3 | 34 | 16.8 |
| | 9 | 144 | 28 | 18.0 | 1 | 41 | 43.9 | | 24 | 204 | 55 | 45.1 | 3 | 38 | 18.8 |
| | 10 | 146 | 23 | 30.3 | 1 | 39 | 09.4 | | 25 | 205 | 12 | 35.2 | 3 | 41 | 35.1 |
| | 11 | 148 | 17 | 13.7 | 1 | 36 | 03.7 | | 26 | 205 | 23 | 33.5 | 3 | 43 | 59.7 |
| | 12 | 150 | 09 | 27.5 | +1 | 32 | 28.4 | | 27 | 205 | 28 | 16.1 | -3 | 45 | 26.1 |
| | 13 | 152 | 00 | 11.3 | 1 | 28 | 25.5 | | 28 | 205 | 26 | 19.6 | 3 | 45 | 47.3 |
| | 14 | 153 | 49 | 25.5 | 1 | 23 | 56.5 | | 29 | 205 | 17 | 22.5 | 3 | 44 | 55.7 |
| | 15 | 155 | 37 | 10.2 | 1 | 19 | 03.1 | | 30 | 205 | 01 | 06.3 | 3 | 42 | 43.5 |
| | 16 | 157 | 23 | 26.1 | +1 | 13 | 46.9 | Oct. | 1 | 204 | 37 | 17.2 | -3 | 39 | 02.7 |

**MERCURY, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| Oct. | 1 | 204 | 37 | 17.2 | -3 | 39 | 02.7 | Nov. | 16 | 226 | 11 | 30.3 | +0 | 45 | 12.7 |
| | 2 | 204 | 05 | 48.6 | 3 | 33 | 45.7 | | 17 | 227 | 47 | 59.0 | 0 | 38 | 25.0 |
| | 3 | 203 | 26 | 42.8 | 3 | 26 | 45.6 | | 18 | 229 | 24 | 17.2 | 0 | 31 | 35.1 |
| | 4 | 202 | 40 | 14.3 | 3 | 17 | 56.8 | | 19 | 231 | 00 | 24.3 | 0 | 24 | 43.9 |
| | 5 | 201 | 46 | 51.7 | 3 | 07 | 15.9 | | 20 | 232 | 36 | 19.8 | 0 | 17 | 52.4 |
| | 6 | 200 | 47 | 20.1 | 2 | 54 | 42.0 | | 21 | 234 | 12 | 03.6 | 0 | 11 | 01.5 |
| | 7 | 199 | 42 | 42.2 | -2 | 40 | 18.2 | | 22 | 235 | 47 | 36.0 | +0 | 04 | 12.0 |
| | 8 | 198 | 34 | 18.4 | 2 | 24 | 11.3 | | 23 | 237 | 22 | 57.2 | -0 | 02 | 35.2 |
| | 9 | 197 | 23 | 45.0 | 2 | 06 | 32.8 | | 24 | 238 | 58 | 07.6 | 0 | 09 | 19.5 |
| | 10 | 196 | 12 | 51.5 | 1 | 47 | 38.2 | | 25 | 240 | 33 | 07.8 | 0 | 16 | 00.0 |
| | 11 | 195 | 03 | 35.2 | 1 | 27 | 46.8 | | 26 | 242 | 07 | 58.6 | 0 | 22 | 36.3 |
| | 12 | 193 | 57 | 55.1 | 1 | 07 | 20.6 | | 27 | 243 | 42 | 40.5 | 0 | 29 | 07.5 |
| | 13 | 192 | 57 | 45.8 | -0 | 46 | 43.0 | | 28 | 245 | 17 | 14.5 | -0 | 35 | 33.2 |
| | 14 | 192 | 04 | 51.1 | 0 | 26 | 17.4 | | 29 | 246 | 51 | 41.6 | 0 | 41 | 52.6 |
| | 15 | 191 | 20 | 38.6 | -0 | 06 | 25.6 | | 30 | 248 | 26 | 02.6 | 0 | 48 | 05.0 |
| | 16 | 190 | 46 | 16.4 | +0 | 12 | 33.1 | Dec. | 1 | 250 | 00 | 18.3 | 0 | 54 | 09.9 |
| | 17 | 190 | 22 | 31.7 | 0 | 30 | 22.6 | | 2 | 251 | 34 | 29.7 | 1 | 00 | 06.7 |
| | 18 | 190 | 09 | 50.2 | 0 | 46 | 50.5 | | 3 | 253 | 08 | 37.8 | 1 | 05 | 54.9 |
| | 19 | 190 | 08 | 18.1 | +1 | 01 | 48.0 | | 4 | 254 | 42 | 43.5 | -1 | 11 | 33.8 |
| | 20 | 190 | 17 | 44.4 | 1 | 15 | 10.0 | | 5 | 256 | 16 | 47.5 | 1 | 17 | 02.7 |
| | 21 | 190 | 37 | 44.1 | 1 | 26 | 54.0 | | 6 | 257 | 50 | 50.8 | 1 | 22 | 21.1 |
| | 22 | 191 | 07 | 41.2 | 1 | 37 | 00.3 | | 7 | 259 | 24 | 53.9 | 1 | 27 | 28.3 |
| | 23 | 191 | 46 | 52.4 | 1 | 45 | 31.2 | | 8 | 260 | 58 | 57.6 | 1 | 32 | 23.6 |
| | 24 | 192 | 34 | 29.6 | 1 | 52 | 30.5 | | 9 | 262 | 33 | 02.5 | 1 | 37 | 06.3 |
| | 25 | 193 | 29 | 42.4 | +1 | 58 | 02.9 | | 10 | 264 | 07 | 09.2 | -1 | 41 | 35.7 |
| | 26 | 194 | 31 | 40.6 | 2 | 02 | 14.0 | | 11 | 265 | 41 | 18.1 | 1 | 45 | 51.1 |
| | 27 | 195 | 39 | 35.2 | 2 | 05 | 09.6 | | 12 | 267 | 15 | 29.6 | 1 | 49 | 51.7 |
| | 28 | 196 | 52 | 40.0 | 2 | 06 | 55.9 | | 13 | 268 | 49 | 44.0 | 1 | 53 | 36.6 |
| | 29 | 198 | 10 | 11.8 | 2 | 07 | 38.9 | | 14 | 270 | 24 | 01.3 | 1 | 57 | 05.0 |
| | 30 | 199 | 31 | 31.4 | 2 | 07 | 24.4 | | 15 | 271 | 58 | 21.4 | 2 | 00 | 16.0 |
| | 31 | 200 | 56 | 03.7 | +2 | 06 | 18.0 | | 16 | 273 | 32 | 43.8 | -2 | 03 | 08.6 |
| Nov. | 1 | 202 | 23 | 17.0 | 2 | 04 | 24.9 | | 17 | 275 | 07 | 07.9 | 2 | 05 | 41.8 |
| | 2 | 203 | 52 | 44.0 | 2 | 01 | 50.1 | | 18 | 276 | 41 | 32.7 | 2 | 07 | 54.4 |
| | 3 | 205 | 24 | 00.5 | 1 | 58 | 38.2 | | 19 | 278 | 15 | 56.8 | 2 | 09 | 45.4 |
| | 4 | 206 | 56 | 45.7 | 1 | 54 | 53.2 | | 20 | 279 | 50 | 18.4 | 2 | 11 | 13.5 |
| | 5 | 208 | 30 | 41.8 | 1 | 50 | 39.0 | | 21 | 281 | 24 | 35.1 | 2 | 12 | 17.3 |
| | 6 | 210 | 05 | 33.6 | +1 | 45 | 59.1 | | 22 | 282 | 58 | 43.9 | -2 | 12 | 55.5 |
| | 7 | 211 | 41 | 08.1 | 1 | 40 | 56.6 | | 23 | 284 | 32 | 41.4 | 2 | 13 | 06.5 |
| | 8 | 213 | 17 | 14.4 | 1 | 35 | 34.4 | | 24 | 286 | 06 | 22.8 | 2 | 12 | 48.6 |
| | 9 | 214 | 53 | 43.3 | 1 | 29 | 55.1 | | 25 | 287 | 39 | 43.0 | 2 | 12 | 00.3 |
| | 10 | 216 | 30 | 27.4 | 1 | 24 | 01.0 | | 26 | 289 | 12 | 35.4 | 2 | 10 | 39.6 |
| | 11 | 218 | 07 | 20.2 | 1 | 17 | 54.3 | | 27 | 290 | 44 | 52.3 | 2 | 08 | 44.5 |
| | 12 | 219 | 44 | 16.8 | +1 | 11 | 36.9 | | 28 | 292 | 16 | 24.3 | -2 | 06 | 13.0 |
| | 13 | 221 | 21 | 13.0 | 1 | 05 | 10.5 | | 29 | 293 | 47 | 00.6 | 2 | 03 | 02.8 |
| | 14 | 222 | 58 | 05.5 | 0 | 58 | 36.7 | | 30 | 295 | 16 | 28.2 | 1 | 59 | 11.6 |
| | 15 | 224 | 34 | 52.0 | 0 | 51 | 57.0 | | 31 | 296 | 44 | 31.9 | 1 | 54 | 36.9 |
| | 16 | 226 | 11 | 30.3 | +0 | 45 | 12.7 | | 32 | 298 | 10 | 53.9 | -1 | 49 | 16.1 |

**MERCURY, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Jan | 0 | 19 | 10 | 53.33 | -24 | 31 | 45.9 | 1.397 870 | 6.29 | 2.40 | 12 | 33 | 01 |
| | 1 | 19 | 17 | 59.09 | 24 | 20 | 58.7 | 1.389 550 | 6.33 | 2.42 | 12 | 36 | 11 |
| | 2 | 19 | 25 | 04.41 | 24 | 08 | 38.8 | 1.380 533 | 6.37 | 2.43 | 12 | 39 | 20 |
| | 3 | 19 | 32 | 09.02 | 23 | 54 | 45.9 | 1.370 798 | 6.42 | 2.45 | 12 | 42 | 28 |
| | 4 | 19 | 39 | 12.63 | 23 | 39 | 19.7 | 1.360 326 | 6.46 | 2.47 | 12 | 45 | 34 |
| | 5 | 19 | 46 | 14.94 | 23 | 22 | 20.1 | 1.349 094 | 6.52 | 2.49 | 12 | 48 | 40 |
| | 6 | 19 | 53 | 15.58 | -23 | 03 | 47.4 | 1.337 081 | 6.58 | 2.51 | 12 | 51 | 43 |
| | 7 | 20 | 00 | 14.16 | 22 | 43 | 41.9 | 1.324 264 | 6.64 | 2.54 | 12 | 54 | 44 |
| | 8 | 20 | 07 | 10.24 | 22 | 22 | 04.5 | 1.310 618 | 6.71 | 2.56 | 12 | 57 | 43 |
| | 9 | 20 | 14 | 03.32 | 21 | 58 | 56.2 | 1.296 120 | 6.78 | 2.59 | 13 | 00 | 38 |
| | 10 | 20 | 20 | 52.84 | 21 | 34 | 18.7 | 1.280 746 | 6.87 | 2.62 | 13 | 03 | 29 |
| | 11 | 20 | 27 | 38.16 | 21 | 08 | 14.1 | 1.264 475 | 6.95 | 2.66 | 13 | 06 | 15 |
| | 12 | 20 | 34 | 18.56 | -20 | 40 | 45.0 | 1.247 285 | 7.05 | 2.69 | 13 | 08 | 56 |
| | 13 | 20 | 40 | 53.20 | 20 | 11 | 55.0 | 1.229 159 | 7.15 | 2.73 | 13 | 11 | 31 |
| | 14 | 20 | 47 | 21.16 | 19 | 41 | 48.3 | 1.210 081 | 7.27 | 2.78 | 13 | 13 | 59 |
| | 15 | 20 | 53 | 41.37 | 19 | 10 | 30.1 | 1.190 044 | 7.39 | 2.82 | 13 | 16 | 18 |
| | 16 | 20 | 59 | 52.62 | 18 | 38 | 06.9 | 1.169 045 | 7.52 | 2.87 | 13 | 18 | 27 |
| | 17 | 21 | 05 | 53.57 | 18 | 04 | 46.3 | 1.147 089 | 7.67 | 2.93 | 13 | 20 | 25 |
| | 18 | 21 | 11 | 42.66 | -17 | 30 | 37.5 | 1.124 196 | 7.82 | 2.99 | 13 | 22 | 10 |
| | 19 | 21 | 17 | 18.17 | 16 | 55 | 51.3 | 1.100 394 | 7.99 | 3.05 | 13 | 23 | 41 |
| | 20 | 21 | 22 | 38.17 | 16 | 20 | 40.2 | 1.075 730 | 8.18 | 3.12 | 13 | 24 | 55 |
| | 21 | 21 | 27 | 40.53 | 15 | 45 | 18.8 | 1.050 269 | 8.37 | 3.20 | 13 | 25 | 50 |
| | 22 | 21 | 32 | 22.89 | 15 | 10 | 03.8 | 1.024 095 | 8.59 | 3.28 | 13 | 26 | 23 |
| | 23 | 21 | 36 | 42.70 | 14 | 35 | 14.0 | 0.997 319 | 8.82 | 3.37 | 13 | 26 | 33 |
| | 24 | 21 | 40 | 37.27 | -14 | 01 | 10.2 | 0.970 075 | 9.07 | 3.46 | 13 | 26 | 16 |
| | 25 | 21 | 44 | 03.74 | 13 | 28 | 15.3 | 0.942 524 | 9.33 | 3.56 | 13 | 25 | 29 |
| | 26 | 21 | 46 | 59.22 | 12 | 56 | 53.9 | 0.914 853 | 9.61 | 3.67 | 13 | 24 | 09 |
| | 27 | 21 | 49 | 20.84 | 12 | 27 | 32.0 | 0.887 277 | 9.91 | 3.79 | 13 | 22 | 14 |
| | 28 | 21 | 51 | 05.89 | 12 | 00 | 36.0 | 0.860 033 | 10.23 | 3.91 | 13 | 19 | 41 |
| | 29 | 21 | 52 | 11.92 | 11 | 36 | 32.5 | 0.833 378 | 10.55 | 4.03 | 13 | 16 | 29 |
| | 30 | 21 | 52 | 36.99 | -11 | 15 | 46.7 | 0.807 582 | 10.89 | 4.16 | 13 | 12 | 35 |
| | 31 | 21 | 52 | 19.78 | 10 | 58 | 41.7 | 0.782 924 | 11.23 | 4.29 | 13 | 07 | 59 |
| Feb | 1 | 21 | 51 | 19.83 | 10 | 45 | 36.9 | 0.759 679 | 11.58 | 4.42 | 13 | 02 | 40 |
| | 2 | 21 | 49 | 37.70 | 10 | 36 | 46.8 | 0.738 112 | 11.91 | 4.55 | 12 | 56 | 41 |
| | 3 | 21 | 47 | 15.13 | 10 | 32 | 19.6 | 0.718 471 | 12.24 | 4.68 | 12 | 50 | 03 |
| | 4 | 21 | 44 | 15.15 | 10 | 32 | 16.4 | 0.700 970 | 12.55 | 4.79 | 12 | 42 | 51 |
| | 5 | 21 | 40 | 42.09 | -10 | 36 | 30.4 | 0.685 789 | 12.82 | 4.90 | 12 | 35 | 08 |
| | 6 | 21 | 36 | 41.46 | 10 | 44 | 46.5 | 0.673 062 | 13.07 | 4.99 | 12 | 27 | 02 |
| | 7 | 21 | 32 | 19.81 | 10 | 56 | 42.3 | 0.662 871 | 13.27 | 5.07 | 12 | 18 | 39 |
| | 8 | 21 | 27 | 44.41 | 11 | 11 | 49.0 | 0.655 248 | 13.42 | 5.13 | 12 | 10 | 06 |
| | 9 | 21 | 23 | 02.86 | 11 | 29 | 33.1 | 0.650 172 | 13.53 | 5.17 | 12 | 01 | 31 |
| | 10 | 21 | 18 | 22.73 | 11 | 49 | 18.3 | 0.647 576 | 13.58 | 5.19 | 11 | 53 | 00 |
| | 11 | 21 | 13 | 51.18 | -12 | 10 | 28.1 | 0.647 347 | 13.58 | 5.19 | 11 | 44 | 42 |
| | 12 | 21 | 09 | 34.58 | 12 | 32 | 27.2 | 0.649 341 | 13.54 | 5.17 | 11 | 36 | 40 |
| | 13 | 21 | 05 | 38.37 | 12 | 54 | 43.4 | 0.653 388 | 13.46 | 5.14 | 11 | 29 | 01 |
| | 14 | 21 | 02 | 06.83 | 13 | 16 | 48.1 | 0.659 299 | 13.34 | 5.10 | 11 | 21 | 48 |
| | 15 | 20 | 59 | 03.17 | -13 | 38 | 17.7 | 0.666 882 | 13.19 | 5.04 | 11 | 15 | 04 |

**MERCURY, 2021**
RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Feb | 15 | 20 | 59 | 03.17 | -13 | 38 | 17.7 | 0.666 882 | 13.19 | 5.04 | 11 | 15 | 04 |
| | 16 | 20 | 56 | 29.47 | 13 | 58 | 52.5 | 0.675 941 | 13.01 | 4.97 | 11 | 08 | 50 |
| | 17 | 20 | 54 | 26.88 | 14 | 18 | 17.3 | 0.686 287 | 12.81 | 4.90 | 11 | 03 | 06 |
| | 18 | 20 | 52 | 55.74 | 14 | 36 | 20.7 | 0.697 739 | 12.60 | 4.82 | 10 | 57 | 54 |
| | 19 | 20 | 51 | 55.72 | 14 | 52 | 54.3 | 0.710 130 | 12.38 | 4.73 | 10 | 53 | 12 |
| | 20 | 20 | 51 | 25.98 | 15 | 07 | 52.2 | 0.723 307 | 12.16 | 4.65 | 10 | 49 | 00 |
| | 21 | 20 | 51 | 25.35 | -15 | 21 | 10.7 | 0.737 132 | 11.93 | 4.56 | 10 | 45 | 16 |
| | 22 | 20 | 51 | 52.37 | 15 | 32 | 47.5 | 0.751 481 | 11.70 | 4.47 | 10 | 41 | 59 |
| | 23 | 20 | 52 | 45.48 | 15 | 42 | 41.6 | 0.766 247 | 11.48 | 4.39 | 10 | 39 | 07 |
| | 24 | 20 | 54 | 03.00 | 15 | 50 | 52.8 | 0.781 333 | 11.26 | 4.30 | 10 | 36 | 38 |
| | 25 | 20 | 55 | 43.28 | 15 | 57 | 21.5 | 0.796 657 | 11.04 | 4.22 | 10 | 34 | 32 |
| | 26 | 20 | 57 | 44.66 | 16 | 02 | 08.4 | 0.812 146 | 10.83 | 4.14 | 10 | 32 | 46 |
| | 27 | 21 | 00 | 05.57 | -16 | 05 | 14.6 | 0.827 738 | 10.62 | 4.06 | 10 | 31 | 18 |
| | 28 | 21 | 02 | 44.50 | 16 | 06 | 41.4 | 0.843 381 | 10.43 | 3.98 | 10 | 30 | 08 |
| Mar | 1 | 21 | 05 | 40.03 | 16 | 06 | 30.0 | 0.859 030 | 10.24 | 3.91 | 10 | 29 | 14 |
| | 2 | 21 | 08 | 50.84 | 16 | 04 | 41.9 | 0.874 644 | 10.05 | 3.84 | 10 | 28 | 34 |
| | 3 | 21 | 12 | 15.68 | 16 | 01 | 18.4 | 0.890 193 | 9.88 | 3.77 | 10 | 28 | 08 |
| | 4 | 21 | 15 | 53.44 | 15 | 56 | 21.0 | 0.905 648 | 9.71 | 3.71 | 10 | 27 | 55 |
| | 5 | 21 | 19 | 43.05 | -15 | 49 | 51.1 | 0.920 985 | 9.55 | 3.65 | 10 | 27 | 53 |
| | 6 | 21 | 23 | 43.56 | 15 | 41 | 49.9 | 0.936 187 | 9.39 | 3.59 | 10 | 28 | 01 |
| | 7 | 21 | 27 | 54.09 | 15 | 32 | 18.9 | 0.951 236 | 9.24 | 3.53 | 10 | 28 | 19 |
| | 8 | 21 | 32 | 13.84 | 15 | 21 | 19.3 | 0.966 119 | 9.10 | 3.48 | 10 | 28 | 46 |
| | 9 | 21 | 36 | 42.07 | 15 | 08 | 52.4 | 0.980 825 | 8.97 | 3.43 | 10 | 29 | 22 |
| | 10 | 21 | 41 | 18.12 | 14 | 54 | 59.3 | 0.995 346 | 8.84 | 3.38 | 10 | 30 | 04 |
| | 11 | 21 | 46 | 01.40 | -14 | 39 | 41.2 | 1.009 674 | 8.71 | 3.33 | 10 | 30 | 54 |
| | 12 | 21 | 50 | 51.37 | 14 | 22 | 59.2 | 1.023 804 | 8.59 | 3.28 | 10 | 31 | 50 |
| | 13 | 21 | 55 | 47.55 | 14 | 04 | 54.5 | 1.037 730 | 8.47 | 3.24 | 10 | 32 | 53 |
| | 14 | 22 | 00 | 49.50 | 13 | 45 | 27.9 | 1.051 449 | 8.36 | 3.20 | 10 | 34 | 00 |
| | 15 | 22 | 05 | 56.83 | 13 | 24 | 40.5 | 1.064 958 | 8.26 | 3.16 | 10 | 35 | 14 |
| | 16 | 22 | 11 | 09.22 | 13 | 02 | 33.3 | 1.078 253 | 8.16 | 3.12 | 10 | 36 | 32 |
| | 17 | 22 | 16 | 26.36 | -12 | 39 | 07.3 | 1.091 333 | 8.06 | 3.08 | 10 | 37 | 54 |
| | 18 | 22 | 21 | 47.98 | 12 | 14 | 23.2 | 1.104 195 | 7.96 | 3.04 | 10 | 39 | 21 |
| | 19 | 22 | 27 | 13.87 | 11 | 48 | 22.1 | 1.116 837 | 7.87 | 3.01 | 10 | 40 | 53 |
| | 20 | 22 | 32 | 43.82 | 11 | 21 | 04.7 | 1.129 255 | 7.79 | 2.98 | 10 | 42 | 28 |
| | 21 | 22 | 38 | 17.67 | 10 | 52 | 32.0 | 1.141 447 | 7.70 | 2.94 | 10 | 44 | 07 |
| | 22 | 22 | 43 | 55.29 | 10 | 22 | 44.8 | 1.153 410 | 7.62 | 2.91 | 10 | 45 | 50 |
| | 23 | 22 | 49 | 36.57 | -9 | 51 | 43.9 | 1.165 139 | 7.55 | 2.88 | 10 | 47 | 36 |
| | 24 | 22 | 55 | 21.43 | 9 | 19 | 30.1 | 1.176 628 | 7.47 | 2.86 | 10 | 49 | 26 |
| | 25 | 23 | 01 | 09.82 | 8 | 46 | 04.2 | 1.187 873 | 7.40 | 2.83 | 10 | 51 | 20 |
| | 26 | 23 | 07 | 01.70 | 8 | 11 | 27.1 | 1.198 866 | 7.34 | 2.80 | 10 | 53 | 17 |
| | 27 | 23 | 12 | 57.06 | 7 | 35 | 39.6 | 1.209 599 | 7.27 | 2.78 | 10 | 55 | 18 |
| | 28 | 23 | 18 | 55.93 | 6 | 58 | 42.5 | 1.220 063 | 7.21 | 2.75 | 10 | 57 | 22 |
| | 29 | 23 | 24 | 58.33 | -6 | 20 | 36.7 | 1.230 245 | 7.15 | 2.73 | 10 | 59 | 29 |
| | 30 | 23 | 31 | 04.34 | 5 | 41 | 23.1 | 1.240 132 | 7.09 | 2.71 | 11 | 01 | 41 |
| | 31 | 23 | 37 | 14.02 | 5 | 01 | 02.5 | 1.249 709 | 7.04 | 2.69 | 11 | 03 | 56 |
| Apr | 1 | 23 | 43 | 27.47 | 4 | 19 | 36.1 | 1.258 959 | 6.99 | 2.67 | 11 | 06 | 15 |
| | 2 | 23 | 49 | 44.79 | -3 | 37 | 05.0 | 1.267 861 | 6.94 | 2.65 | 11 | 08 | 38 |

**MERCURY, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Apr | 1 | 23 | 43 | 27.47 | -4 | 19 | 36.1 | 1.258 959 | 6.99 | 2.67 | 11 | 06 | 15 |
| | 2 | 23 | 49 | 44.79 | 3 | 37 | 05.0 | 1.267 861 | 6.94 | 2.65 | 11 | 08 | 38 |
| | 3 | 23 | 56 | 06.12 | 2 | 53 | 30.2 | 1.276 393 | 6.89 | 2.63 | 11 | 11 | 04 |
| | 4 | 0 | 02 | 31.59 | 2 | 08 | 53.3 | 1.284 529 | 6.85 | 2.62 | 11 | 13 | 36 |
| | 5 | 0 | 09 | 01.34 | 1 | 23 | 15.7 | 1.292 240 | 6.81 | 2.60 | 11 | 16 | 11 |
| | 6 | 0 | 15 | 35.54 | -0 | 36 | 39.0 | 1.299 494 | 6.77 | 2.59 | 11 | 18 | 51 |
| | 7 | 0 | 22 | 14.36 | +0 | 10 | 54.7 | 1.306 257 | 6.73 | 2.57 | 11 | 21 | 36 |
| | 8 | 0 | 28 | 57.97 | 0 | 59 | 23.4 | 1.312 487 | 6.70 | 2.56 | 11 | 24 | 26 |
| | 9 | 0 | 35 | 46.57 | 1 | 48 | 44.7 | 1.318 143 | 6.67 | 2.55 | 11 | 27 | 21 |
| | 10 | 0 | 42 | 40.32 | 2 | 38 | 55.6 | 1.323 176 | 6.65 | 2.54 | 11 | 30 | 21 |
| | 11 | 0 | 49 | 39.41 | 3 | 29 | 53.1 | 1.327 536 | 6.62 | 2.53 | 11 | 33 | 26 |
| | 12 | 0 | 56 | 44.00 | 4 | 21 | 33.4 | 1.331 166 | 6.61 | 2.52 | 11 | 36 | 37 |
| | 13 | 1 | 03 | 54.23 | +5 | 13 | 52.3 | 1.334 008 | 6.59 | 2.52 | 11 | 39 | 54 |
| | 14 | 1 | 11 | 10.22 | 6 | 06 | 45.1 | 1.335 998 | 6.58 | 2.51 | 11 | 43 | 17 |
| | 15 | 1 | 18 | 32.05 | 7 | 00 | 06.1 | 1.337 070 | 6.58 | 2.51 | 11 | 46 | 46 |
| | 16 | 1 | 25 | 59.75 | 7 | 53 | 49.1 | 1.337 158 | 6.58 | 2.51 | 11 | 50 | 20 |
| | 17 | 1 | 33 | 33.29 | 8 | 47 | 47.1 | 1.336 191 | 6.58 | 2.51 | 11 | 54 | 01 |
| | 18 | 1 | 41 | 12.57 | 9 | 41 | 52.0 | 1.334 101 | 6.59 | 2.52 | 11 | 57 | 47 |
| | 19 | 1 | 48 | 57.40 | +10 | 35 | 55.1 | 1.330 823 | 6.61 | 2.52 | 12 | 01 | 38 |
| | 20 | 1 | 56 | 47.50 | 11 | 29 | 46.9 | 1.326 295 | 6.63 | 2.53 | 12 | 05 | 35 |
| | 21 | 2 | 04 | 42.46 | 12 | 23 | 16.6 | 1.320 464 | 6.66 | 2.54 | 12 | 09 | 36 |
| | 22 | 2 | 12 | 41.77 | 13 | 16 | 12.8 | 1.313 284 | 6.70 | 2.56 | 12 | 13 | 42 |
| | 23 | 2 | 20 | 44.80 | 14 | 08 | 23.8 | 1.304 724 | 6.74 | 2.58 | 12 | 17 | 51 |
| | 24 | 2 | 28 | 50.77 | 14 | 59 | 37.2 | 1.294 765 | 6.79 | 2.60 | 12 | 22 | 02 |
| | 25 | 2 | 36 | 58.81 | +15 | 49 | 40.4 | 1.283 408 | 6.85 | 2.62 | 12 | 26 | 15 |
| | 26 | 2 | 45 | 07.91 | 16 | 38 | 21.1 | 1.270 670 | 6.92 | 2.64 | 12 | 30 | 28 |
| | 27 | 2 | 53 | 17.00 | 17 | 25 | 27.0 | 1.256 588 | 7.00 | 2.67 | 12 | 34 | 41 |
| | 28 | 3 | 01 | 24.90 | 18 | 10 | 46.8 | 1.241 216 | 7.09 | 2.71 | 12 | 38 | 52 |
| | 29 | 3 | 09 | 30.40 | 18 | 54 | 10.1 | 1.224 630 | 7.18 | 2.74 | 12 | 42 | 60 |
| | 30 | 3 | 17 | 32.25 | 19 | 35 | 27.6 | 1.206 916 | 7.29 | 2.78 | 12 | 47 | 03 |
| May | 1 | 3 | 25 | 29.20 | +20 | 14 | 31.4 | 1.188 177 | 7.40 | 2.83 | 12 | 51 | 01 |
| | 2 | 3 | 33 | 20.02 | 20 | 51 | 15.1 | 1.168 525 | 7.53 | 2.88 | 12 | 54 | 52 |
| | 3 | 3 | 41 | 03.53 | 21 | 25 | 33.8 | 1.148 076 | 7.66 | 2.93 | 12 | 58 | 36 |
| | 4 | 3 | 48 | 38.59 | 21 | 57 | 24.1 | 1.126 953 | 7.80 | 2.98 | 13 | 02 | 10 |
| | 5 | 3 | 56 | 04.14 | 22 | 26 | 44.1 | 1.105 275 | 7.96 | 3.04 | 13 | 05 | 33 |
| | 6 | 4 | 03 | 19.19 | 22 | 53 | 33.3 | 1.083 161 | 8.12 | 3.10 | 13 | 08 | 46 |
| | 7 | 4 | 10 | 22.83 | +23 | 17 | 52.2 | 1.060 725 | 8.29 | 3.17 | 13 | 11 | 47 |
| | 8 | 4 | 17 | 14.20 | 23 | 39 | 42.5 | 1.038 074 | 8.47 | 3.24 | 13 | 14 | 35 |
| | 9 | 4 | 23 | 52.53 | 23 | 59 | 06.8 | 1.015 308 | 8.66 | 3.31 | 13 | 17 | 10 |
| | 10 | 4 | 30 | 17.08 | 24 | 16 | 08.1 | 0.992 520 | 8.86 | 3.39 | 13 | 19 | 30 |
| | 11 | 4 | 36 | 27.20 | 24 | 30 | 50.3 | 0.969 794 | 9.07 | 3.46 | 13 | 21 | 35 |
| | 12 | 4 | 42 | 22.25 | 24 | 43 | 17.5 | 0.947 207 | 9.28 | 3.55 | 13 | 23 | 25 |
| | 13 | 4 | 48 | 01.65 | +24 | 53 | 34.2 | 0.924 828 | 9.51 | 3.63 | 13 | 24 | 59 |
| | 14 | 4 | 53 | 24.85 | 25 | 01 | 45.1 | 0.902 721 | 9.74 | 3.72 | 13 | 26 | 17 |
| | 15 | 4 | 58 | 31.30 | 25 | 07 | 54.8 | 0.880 940 | 9.98 | 3.81 | 13 | 27 | 17 |
| | 16 | 5 | 03 | 20.51 | 25 | 12 | 08.3 | 0.859 538 | 10.23 | 3.91 | 13 | 27 | 60 |
| | 17 | 5 | 07 | 51.99 | +25 | 14 | 30.3 | 0.838 561 | 10.49 | 4.01 | 13 | 28 | 25 |

**MERCURY, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| May | 17 | 5 | 07 | 51.99 | +25 | 14 | 30.3 | 0.838 561 | 10.49 | 4.01 | 13 | 28 | 25 |
| | 18 | 5 | 12 | 05.26 | 25 | 15 | 05.7 | 0.818 051 | 10.75 | 4.11 | 13 | 28 | 31 |
| | 19 | 5 | 15 | 59.87 | 25 | 13 | 59.0 | 0.798 048 | 11.02 | 4.21 | 13 | 28 | 18 |
| | 20 | 5 | 19 | 35.40 | 25 | 11 | 14.8 | 0.778 587 | 11.30 | 4.32 | 13 | 27 | 46 |
| | 21 | 5 | 22 | 51.44 | 25 | 06 | 57.8 | 0.759 703 | 11.58 | 4.42 | 13 | 26 | 55 |
| | 22 | 5 | 25 | 47.62 | 25 | 01 | 12.1 | 0.741 429 | 11.86 | 4.53 | 13 | 25 | 43 |
| | 23 | 5 | 28 | 23.62 | +24 | 54 | 02.2 | 0.723 796 | 12.15 | 4.64 | 13 | 24 | 11 |
| | 24 | 5 | 30 | 39.16 | 24 | 45 | 32.2 | 0.706 837 | 12.44 | 4.75 | 13 | 22 | 19 |
| | 25 | 5 | 32 | 34.02 | 24 | 35 | 46.3 | 0.690 581 | 12.73 | 4.87 | 13 | 20 | 06 |
| | 26 | 5 | 34 | 08.06 | 24 | 24 | 48.7 | 0.675 060 | 13.03 | 4.98 | 13 | 17 | 32 |
| | 27 | 5 | 35 | 21.25 | 24 | 12 | 43.7 | 0.660 304 | 13.32 | 5.09 | 13 | 14 | 38 |
| | 28 | 5 | 36 | 13.64 | 23 | 59 | 35.5 | 0.646 343 | 13.61 | 5.20 | 13 | 11 | 23 |
| | 29 | 5 | 36 | 45.42 | +23 | 45 | 28.5 | 0.633 208 | 13.89 | 5.31 | 13 | 07 | 47 |
| | 30 | 5 | 36 | 56.93 | 23 | 30 | 27.5 | 0.620 930 | 14.16 | 5.41 | 13 | 03 | 52 |
| | 31 | 5 | 36 | 48.65 | 23 | 14 | 37.4 | 0.609 540 | 14.43 | 5.51 | 12 | 59 | 37 |
| Jun | 1 | 5 | 36 | 21.27 | 22 | 58 | 03.4 | 0.599 067 | 14.68 | 5.61 | 12 | 55 | 04 |
| | 2 | 5 | 35 | 35.64 | 22 | 40 | 51.5 | 0.589 543 | 14.92 | 5.70 | 12 | 50 | 14 |
| | 3 | 5 | 34 | 32.84 | 22 | 23 | 07.9 | 0.580 995 | 15.14 | 5.78 | 12 | 45 | 07 |
| | 4 | 5 | 33 | 14.15 | +22 | 04 | 59.6 | 0.573 451 | 15.34 | 5.86 | 12 | 39 | 45 |
| | 5 | 5 | 31 | 41.07 | 21 | 46 | 34.2 | 0.566 938 | 15.51 | 5.93 | 12 | 34 | 10 |
| | 6 | 5 | 29 | 55.28 | 21 | 27 | 59.7 | 0.561 478 | 15.66 | 5.98 | 12 | 28 | 23 |
| | 7 | 5 | 27 | 58.68 | 21 | 09 | 25.2 | 0.557 093 | 15.79 | 6.03 | 12 | 22 | 27 |
| | 8 | 5 | 25 | 53.31 | 20 | 51 | 00.0 | 0.553 800 | 15.88 | 6.07 | 12 | 16 | 22 |
| | 9 | 5 | 23 | 41.36 | 20 | 32 | 53.9 | 0.551 614 | 15.94 | 6.09 | 12 | 10 | 13 |
| | 10 | 5 | 21 | 25.12 | +20 | 15 | 17.2 | 0.550 544 | 15.97 | 6.10 | 12 | 04 | 01 |
| | 11 | 5 | 19 | 06.94 | 19 | 58 | 20.0 | 0.550 596 | 15.97 | 6.10 | 11 | 57 | 47 |
| | 12 | 5 | 16 | 49.17 | 19 | 42 | 12.6 | 0.551 771 | 15.94 | 6.09 | 11 | 51 | 36 |
| | 13 | 5 | 14 | 34.17 | 19 | 27 | 04.8 | 0.554 066 | 15.87 | 6.06 | 11 | 45 | 28 |
| | 14 | 5 | 12 | 24.18 | 19 | 13 | 06.0 | 0.557 474 | 15.77 | 6.03 | 11 | 39 | 26 |
| | 15 | 5 | 10 | 21.36 | 19 | 00 | 24.5 | 0.561 984 | 15.65 | 5.98 | 11 | 33 | 32 |
| | 16 | 5 | 08 | 27.74 | +18 | 49 | 08.1 | 0.567 579 | 15.49 | 5.92 | 11 | 27 | 49 |
| | 17 | 5 | 06 | 45.14 | 18 | 39 | 23.1 | 0.574 242 | 15.31 | 5.85 | 11 | 22 | 17 |
| | 18 | 5 | 05 | 15.25 | 18 | 31 | 14.7 | 0.581 950 | 15.11 | 5.77 | 11 | 16 | 58 |
| | 19 | 5 | 03 | 59.52 | 18 | 24 | 46.9 | 0.590 681 | 14.89 | 5.69 | 11 | 11 | 54 |
| | 20 | 5 | 02 | 59.22 | 18 | 20 | 02.1 | 0.600 407 | 14.65 | 5.60 | 11 | 07 | 05 |
| | 21 | 5 | 02 | 15.45 | 18 | 17 | 01.9 | 0.611 101 | 14.39 | 5.50 | 11 | 02 | 34 |
| | 22 | 5 | 01 | 49.09 | +18 | 15 | 46.0 | 0.622 735 | 14.12 | 5.40 | 10 | 58 | 20 |
| | 23 | 5 | 01 | 40.86 | 18 | 16 | 13.4 | 0.635 280 | 13.84 | 5.29 | 10 | 54 | 24 |
| | 24 | 5 | 01 | 51.34 | 18 | 18 | 21.9 | 0.648 705 | 13.56 | 5.18 | 10 | 50 | 47 |
| | 25 | 5 | 02 | 20.96 | 18 | 22 | 08.1 | 0.662 981 | 13.26 | 5.07 | 10 | 47 | 30 |
| | 26 | 5 | 03 | 10.03 | 18 | 27 | 28.0 | 0.678 076 | 12.97 | 4.96 | 10 | 44 | 31 |
| | 27 | 5 | 04 | 18.76 | 18 | 34 | 16.4 | 0.693 961 | 12.67 | 4.84 | 10 | 41 | 52 |
| | 28 | 5 | 05 | 47.29 | +18 | 42 | 27.9 | 0.710 605 | 12.38 | 4.73 | 10 | 39 | 33 |
| | 29 | 5 | 07 | 35.68 | 18 | 51 | 56.2 | 0.727 977 | 12.08 | 4.62 | 10 | 37 | 34 |
| | 30 | 5 | 09 | 43.94 | 19 | 02 | 34.4 | 0.746 046 | 11.79 | 4.50 | 10 | 35 | 55 |
| Jul | 1 | 5 | 12 | 12.07 | 19 | 14 | 15.4 | 0.764 779 | 11.50 | 4.39 | 10 | 34 | 35 |
| | 2 | 5 | 15 | 00.02 | +19 | 26 | 51.6 | 0.784 145 | 11.21 | 4.28 | 10 | 33 | 35 |

**MERCURY, 2021**
RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Jul | 1 | 5 | 12 | 12.07 | +19 | 14 | 15.4 | 0.764 779 | 11.50 | 4.39 | 10 | 34 | 35 |
| | 2 | 5 | 15 | 00.02 | 19 | 26 | 51.6 | 0.784 145 | 11.21 | 4.28 | 10 | 33 | 35 |
| | 3 | 5 | 18 | 07.73 | 19 | 40 | 14.9 | 0.804 108 | 10.94 | 4.18 | 10 | 32 | 55 |
| | 4 | 5 | 21 | 35.13 | 19 | 54 | 17.1 | 0.824 634 | 10.66 | 4.07 | 10 | 32 | 35 |
| | 5 | 5 | 25 | 22.14 | 20 | 08 | 49.4 | 0.845 681 | 10.40 | 3.97 | 10 | 32 | 34 |
| | 6 | 5 | 29 | 28.69 | 20 | 23 | 42.8 | 0.867 210 | 10.14 | 3.87 | 10 | 32 | 52 |
| | 7 | 5 | 33 | 54.69 | +20 | 38 | 48.0 | 0.889 174 | 9.89 | 3.78 | 10 | 33 | 30 |
| | 8 | 5 | 38 | 40.03 | 20 | 53 | 55.1 | 0.911 523 | 9.65 | 3.69 | 10 | 34 | 28 |
| | 9 | 5 | 43 | 44.62 | 21 | 08 | 54.3 | 0.934 201 | 9.41 | 3.60 | 10 | 35 | 44 |
| | 10 | 5 | 49 | 08.30 | 21 | 23 | 34.8 | 0.957 147 | 9.19 | 3.51 | 10 | 37 | 20 |
| | 11 | 5 | 54 | 50.90 | 21 | 37 | 46.1 | 0.980 291 | 8.97 | 3.43 | 10 | 39 | 14 |
| | 12 | 6 | 00 | 52.21 | 21 | 51 | 16.9 | 1.003 559 | 8.76 | 3.35 | 10 | 41 | 27 |
| | 13 | 6 | 07 | 11.93 | +22 | 03 | 55.7 | 1.026 867 | 8.56 | 3.27 | 10 | 43 | 59 |
| | 14 | 6 | 13 | 49.69 | 22 | 15 | 30.8 | 1.050 122 | 8.37 | 3.20 | 10 | 46 | 48 |
| | 15 | 6 | 20 | 45.02 | 22 | 25 | 50.4 | 1.073 225 | 8.19 | 3.13 | 10 | 49 | 55 |
| | 16 | 6 | 27 | 57.32 | 22 | 34 | 42.4 | 1.096 069 | 8.02 | 3.07 | 10 | 53 | 19 |
| | 17 | 6 | 35 | 25.86 | 22 | 41 | 55.2 | 1.118 539 | 7.86 | 3.00 | 10 | 56 | 59 |
| | 18 | 6 | 43 | 09.76 | 22 | 47 | 17.3 | 1.140 517 | 7.71 | 2.95 | 11 | 00 | 53 |
| | 19 | 6 | 51 | 07.96 | +22 | 50 | 37.7 | 1.161 879 | 7.57 | 2.89 | 11 | 05 | 02 |
| | 20 | 6 | 59 | 19.26 | 22 | 51 | 46.5 | 1.182 502 | 7.44 | 2.84 | 11 | 09 | 23 |
| | 21 | 7 | 07 | 42.26 | 22 | 50 | 34.6 | 1.202 264 | 7.31 | 2.79 | 11 | 13 | 55 |
| | 22 | 7 | 16 | 15.43 | 22 | 46 | 54.4 | 1.221 050 | 7.20 | 2.75 | 11 | 18 | 37 |
| | 23 | 7 | 24 | 57.11 | 22 | 40 | 39.9 | 1.238 754 | 7.10 | 2.71 | 11 | 23 | 26 |
| | 24 | 7 | 33 | 45.53 | 22 | 31 | 46.9 | 1.255 279 | 7.01 | 2.68 | 11 | 28 | 22 |
| | 25 | 7 | 42 | 38.88 | +22 | 20 | 13.0 | 1.270 547 | 6.92 | 2.64 | 11 | 33 | 21 |
| | 26 | 7 | 51 | 35.34 | 22 | 05 | 58.1 | 1.284 495 | 6.85 | 2.62 | 11 | 38 | 23 |
| | 27 | 8 | 00 | 33.10 | 21 | 49 | 03.6 | 1.297 079 | 6.78 | 2.59 | 11 | 43 | 26 |
| | 28 | 8 | 09 | 30.46 | 21 | 29 | 33.0 | 1.308 275 | 6.72 | 2.57 | 11 | 48 | 27 |
| | 29 | 8 | 18 | 25.80 | 21 | 07 | 31.4 | 1.318 076 | 6.67 | 2.55 | 11 | 53 | 25 |
| | 30 | 8 | 27 | 17.68 | 20 | 43 | 05.1 | 1.326 493 | 6.63 | 2.53 | 11 | 58 | 19 |
| | 31 | 8 | 36 | 04.78 | +20 | 16 | 22.0 | 1.333 552 | 6.59 | 2.52 | 12 | 03 | 08 |
| Aug | 1 | 8 | 44 | 46.00 | 19 | 47 | 30.2 | 1.339 293 | 6.57 | 2.51 | 12 | 07 | 50 |
| | 2 | 8 | 53 | 20.39 | 19 | 16 | 38.8 | 1.343 766 | 6.54 | 2.50 | 12 | 12 | 25 |
| | 3 | 9 | 01 | 47.19 | 18 | 43 | 57.1 | 1.347 026 | 6.53 | 2.49 | 12 | 16 | 52 |
| | 4 | 9 | 10 | 05.81 | 18 | 09 | 34.6 | 1.349 138 | 6.52 | 2.49 | 12 | 21 | 10 |
| | 5 | 9 | 18 | 15.79 | 17 | 33 | 40.4 | 1.350 165 | 6.51 | 2.49 | 12 | 25 | 20 |
| | 6 | 9 | 26 | 16.83 | +16 | 56 | 23.7 | 1.350 176 | 6.51 | 2.49 | 12 | 29 | 20 |
| | 7 | 9 | 34 | 08.75 | 16 | 17 | 53.1 | 1.349 235 | 6.52 | 2.49 | 12 | 33 | 11 |
| | 8 | 9 | 41 | 51.46 | 15 | 38 | 17.1 | 1.347 407 | 6.53 | 2.49 | 12 | 36 | 53 |
| | 9 | 9 | 49 | 24.94 | 14 | 57 | 43.5 | 1.344 755 | 6.54 | 2.50 | 12 | 40 | 26 |
| | 10 | 9 | 56 | 49.28 | 14 | 16 | 19.5 | 1.341 337 | 6.56 | 2.50 | 12 | 43 | 49 |
| | 11 | 10 | 04 | 04.60 | 13 | 34 | 12.3 | 1.337 207 | 6.58 | 2.51 | 12 | 47 | 04 |
| | 12 | 10 | 11 | 11.05 | +12 | 51 | 28.0 | 1.332 418 | 6.60 | 2.52 | 12 | 50 | 10 |
| | 13 | 10 | 18 | 08.84 | 12 | 08 | 12.7 | 1.327 016 | 6.63 | 2.53 | 12 | 53 | 07 |
| | 14 | 10 | 24 | 58.20 | 11 | 24 | 31.9 | 1.321 045 | 6.66 | 2.54 | 12 | 55 | 55 |
| | 15 | 10 | 31 | 39.35 | 10 | 40 | 30.7 | 1.314 545 | 6.69 | 2.56 | 12 | 58 | 36 |
| | 16 | 10 | 38 | 12.56 | +9 | 56 | 13.8 | 1.307 550 | 6.73 | 2.57 | 13 | 01 | 09 |

**MERCURY, 2021**
RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Aug | 16 | 10 | 38 | 12.56 | +9 | 56 | 13.8 | 1.307 550 | 6.73 | 2.57 | 13 | 01 | 09 |
| | 17 | 10 | 44 | 38.05 | 9 | 11 | 45.5 | 1.300 094 | 6.76 | 2.58 | 13 | 03 | 34 |
| | 18 | 10 | 50 | 56.09 | 8 | 27 | 10.0 | 1.292 206 | 6.81 | 2.60 | 13 | 05 | 51 |
| | 19 | 10 | 57 | 06.92 | 7 | 42 | 31.0 | 1.283 910 | 6.85 | 2.62 | 13 | 08 | 02 |
| | 20 | 11 | 03 | 10.76 | 6 | 57 | 52.0 | 1.275 231 | 6.90 | 2.63 | 13 | 10 | 06 |
| | 21 | 11 | 09 | 07.86 | 6 | 13 | 16.2 | 1.266 189 | 6.95 | 2.65 | 13 | 12 | 03 |
| | 22 | 11 | 14 | 58.41 | +5 | 28 | 46.9 | 1.256 802 | 7.00 | 2.67 | 13 | 13 | 54 |
| | 23 | 11 | 20 | 42.62 | 4 | 44 | 26.7 | 1.247 084 | 7.05 | 2.69 | 13 | 15 | 38 |
| | 24 | 11 | 26 | 20.68 | 4 | 00 | 18.4 | 1.237 051 | 7.11 | 2.72 | 13 | 17 | 16 |
| | 25 | 11 | 31 | 52.77 | 3 | 16 | 24.7 | 1.226 713 | 7.17 | 2.74 | 13 | 18 | 49 |
| | 26 | 11 | 37 | 19.02 | 2 | 32 | 48.0 | 1.216 081 | 7.23 | 2.76 | 13 | 20 | 15 |
| | 27 | 11 | 42 | 39.58 | 1 | 49 | 30.7 | 1.205 164 | 7.30 | 2.79 | 13 | 21 | 36 |
| | 28 | 11 | 47 | 54.55 | +1 | 06 | 35.1 | 1.193 968 | 7.37 | 2.81 | 13 | 22 | 52 |
| | 29 | 11 | 53 | 04.03 | 0 | 24 | 03.6 | 1.182 500 | 7.44 | 2.84 | 13 | 24 | 02 |
| | 30 | 11 | 58 | 08.09 | 0 | 18 | 01.7 | 1.170 765 | 7.51 | 2.87 | 13 | 25 | 06 |
| | 31 | 12 | 03 | 06.76 | +0 | 59 | 38.4 | 1.158 768 | 7.59 | 2.90 | 13 | 26 | 05 |
| Sep | 1 | 12 | 08 | 00.06 | -1 | 40 | 44.3 | 1.146 512 | 7.67 | 2.93 | 13 | 26 | 59 |
| | 2 | 12 | 12 | 47.99 | 2 | 21 | 17.1 | 1.134 000 | 7.75 | 2.96 | 13 | 27 | 47 |
| | 3 | 12 | 17 | 30.51 | -3 | 01 | 14.5 | 1.121 236 | 7.84 | 3.00 | 13 | 28 | 30 |
| | 4 | 12 | 22 | 07.54 | 3 | 40 | 33.9 | 1.108 221 | 7.94 | 3.03 | 13 | 29 | 08 |
| | 5 | 12 | 26 | 38.99 | 4 | 19 | 13.0 | 1.094 959 | 8.03 | 3.07 | 13 | 29 | 39 |
| | 6 | 12 | 31 | 04.71 | 4 | 57 | 09.0 | 1.081 452 | 8.13 | 3.11 | 13 | 30 | 05 |
| | 7 | 12 | 35 | 24.54 | 5 | 34 | 19.2 | 1.067 702 | 8.24 | 3.15 | 13 | 30 | 25 |
| | 8 | 12 | 39 | 38.26 | 6 | 10 | 40.8 | 1.053 712 | 8.35 | 3.19 | 13 | 30 | 39 |
| | 9 | 12 | 43 | 45.62 | -6 | 46 | 10.5 | 1.039 486 | 8.46 | 3.23 | 13 | 30 | 46 |
| | 10 | 12 | 47 | 46.30 | 7 | 20 | 45.1 | 1.025 030 | 8.58 | 3.28 | 13 | 30 | 46 |
| | 11 | 12 | 51 | 39.95 | 7 | 54 | 20.9 | 1.010 347 | 8.70 | 3.33 | 13 | 30 | 39 |
| | 12 | 12 | 55 | 26.17 | 8 | 26 | 54.1 | 0.995 446 | 8.83 | 3.38 | 13 | 30 | 24 |
| | 13 | 12 | 59 | 04.47 | 8 | 58 | 20.4 | 0.980 335 | 8.97 | 3.43 | 13 | 30 | 01 |
| | 14 | 13 | 02 | 34.33 | 9 | 28 | 35.1 | 0.965 025 | 9.11 | 3.48 | 13 | 29 | 30 |
| | 15 | 13 | 05 | 55.13 | -9 | 57 | 33.3 | 0.949 528 | 9.26 | 3.54 | 13 | 28 | 48 |
| | 16 | 13 | 09 | 06.19 | 10 | 25 | 09.3 | 0.933 860 | 9.42 | 3.60 | 13 | 27 | 57 |
| | 17 | 13 | 12 | 06.75 | 10 | 51 | 17.2 | 0.918 040 | 9.58 | 3.66 | 13 | 26 | 55 |
| | 18 | 13 | 14 | 55.98 | 11 | 15 | 50.1 | 0.902 090 | 9.75 | 3.72 | 13 | 25 | 41 |
| | 19 | 13 | 17 | 32.95 | 11 | 38 | 40.7 | 0.886 037 | 9.93 | 3.79 | 13 | 24 | 14 |
| | 20 | 13 | 19 | 56.64 | 11 | 59 | 40.9 | 0.869 913 | 10.11 | 3.86 | 13 | 22 | 34 |
| | 21 | 13 | 22 | 05.94 | -12 | 18 | 41.7 | 0.853 755 | 10.30 | 3.94 | 13 | 20 | 38 |
| | 22 | 13 | 23 | 59.68 | 12 | 35 | 33.3 | 0.837 607 | 10.50 | 4.01 | 13 | 18 | 26 |
| | 23 | 13 | 25 | 36.58 | 12 | 50 | 04.9 | 0.821 522 | 10.70 | 4.09 | 13 | 15 | 57 |
| | 24 | 13 | 26 | 55.29 | 13 | 02 | 04.7 | 0.805 560 | 10.92 | 4.17 | 13 | 13 | 09 |
| | 25 | 13 | 27 | 54.43 | 13 | 11 | 19.9 | 0.789 791 | 11.13 | 4.25 | 13 | 10 | 00 |
| | 26 | 13 | 28 | 32.58 | 13 | 17 | 37.0 | 0.774 298 | 11.36 | 4.34 | 13 | 06 | 30 |
| | 27 | 13 | 28 | 48.34 | -13 | 20 | 41.3 | 0.759 175 | 11.58 | 4.43 | 13 | 02 | 37 |
| | 28 | 13 | 28 | 40.41 | 13 | 20 | 18.1 | 0.744 530 | 11.81 | 4.51 | 12 | 58 | 20 |
| | 29 | 13 | 28 | 07.59 | 13 | 16 | 12.2 | 0.730 486 | 12.04 | 4.60 | 12 | 53 | 38 |
| | 30 | 13 | 27 | 08.97 | 13 | 08 | 09.2 | 0.717 180 | 12.26 | 4.69 | 12 | 48 | 30 |
| Oct | 1 | 13 | 25 | 43.92 | -12 | 55 | 55.6 | 0.704 767 | 12.48 | 4.77 | 12 | 42 | 56 |

**MERCURY, 2021**
RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Oct | 1 | 13 | 25 | 43.92 | -12 | 55 | 55.6 | 0.704 767 | 12.48 | 4.77 | 12 | 42 | 56 |
| | 2 | 13 | 23 | 52.34 | 12 | 39 | 21.0 | 0.693 417 | 12.68 | 4.85 | 12 | 36 | 55 |
| | 3 | 13 | 21 | 34.69 | 12 | 18 | 18.3 | 0.683 312 | 12.87 | 4.92 | 12 | 30 | 30 |
| | 4 | 13 | 18 | 52.18 | 11 | 52 | 46.1 | 0.674 648 | 13.04 | 4.98 | 12 | 23 | 40 |
| | 5 | 13 | 15 | 46.91 | 11 | 22 | 50.1 | 0.667 628 | 13.17 | 5.03 | 12 | 16 | 30 |
| | 6 | 13 | 12 | 21.89 | 10 | 48 | 45.1 | 0.662 455 | 13.28 | 5.07 | 12 | 09 | 02 |
| | 7 | 13 | 08 | 41.15 | -10 | 10 | 55.9 | 0.659 329 | 13.34 | 5.10 | 12 | 01 | 22 |
| | 8 | 13 | 04 | 49.66 | 9 | 29 | 58.5 | 0.658 435 | 13.36 | 5.10 | 11 | 53 | 33 |
| | 9 | 13 | 00 | 53.22 | 8 | 46 | 39.9 | 0.659 934 | 13.33 | 5.09 | 11 | 45 | 42 |
| | 10 | 12 | 56 | 58.24 | 8 | 01 | 56.5 | 0.663 955 | 13.25 | 5.06 | 11 | 37 | 57 |
| | 11 | 12 | 53 | 11.45 | 7 | 16 | 52.0 | 0.670 583 | 13.11 | 5.01 | 11 | 30 | 22 |
| | 12 | 12 | 49 | 39.57 | 6 | 32 | 33.9 | 0.679 856 | 12.94 | 4.94 | 11 | 23 | 05 |
| | 13 | 12 | 46 | 28.94 | -5 | 50 | 09.8 | 0.691 757 | 12.71 | 4.86 | 11 | 16 | 12 |
| | 14 | 12 | 43 | 45.18 | 5 | 10 | 42.9 | 0.706 212 | 12.45 | 4.76 | 11 | 09 | 47 |
| | 15 | 12 | 41 | 33.00 | 4 | 35 | 09.0 | 0.723 096 | 12.16 | 4.65 | 11 | 03 | 56 |
| | 16 | 12 | 39 | 55.94 | 4 | 04 | 14.0 | 0.742 233 | 11.85 | 4.53 | 10 | 58 | 40 |
| | 17 | 12 | 38 | 56.36 | 3 | 38 | 31.7 | 0.763 407 | 11.52 | 4.40 | 10 | 54 | 03 |
| | 18 | 12 | 38 | 35.44 | 3 | 18 | 24.4 | 0.786 369 | 11.18 | 4.27 | 10 | 50 | 03 |
| | 19 | 12 | 38 | 53.29 | -3 | 04 | 02.6 | 0.810 846 | 10.85 | 4.14 | 10 | 46 | 42 |
| | 20 | 12 | 39 | 49.05 | 2 | 55 | 26.8 | 0.836 553 | 10.51 | 4.02 | 10 | 43 | 58 |
| | 21 | 12 | 41 | 21.11 | 2 | 52 | 28.7 | 0.863 203 | 10.19 | 3.89 | 10 | 41 | 50 |
| | 22 | 12 | 43 | 27.31 | 2 | 54 | 53.3 | 0.890 514 | 9.88 | 3.77 | 10 | 40 | 14 |
| | 23 | 12 | 46 | 05.07 | 3 | 02 | 20.3 | 0.918 217 | 9.58 | 3.66 | 10 | 39 | 08 |
| | 24 | 12 | 49 | 11.59 | 3 | 14 | 26.1 | 0.946 064 | 9.30 | 3.55 | 10 | 38 | 30 |
| | 25 | 12 | 52 | 43.98 | -3 | 30 | 45.0 | 0.973 830 | 9.03 | 3.45 | 10 | 38 | 16 |
| | 26 | 12 | 56 | 39.40 | 3 | 50 | 50.4 | 1.001 315 | 8.78 | 3.36 | 10 | 38 | 24 |
| | 27 | 13 | 00 | 55.08 | 4 | 14 | 15.9 | 1.028 350 | 8.55 | 3.27 | 10 | 38 | 52 |
| | 28 | 13 | 05 | 28.47 | 4 | 40 | 35.8 | 1.054 791 | 8.34 | 3.19 | 10 | 39 | 36 |
| | 29 | 13 | 10 | 17.20 | 5 | 09 | 25.7 | 1.080 523 | 8.14 | 3.11 | 10 | 40 | 34 |
| | 30 | 13 | 15 | 19.14 | 5 | 40 | 22.9 | 1.105 452 | 7.96 | 3.04 | 10 | 41 | 45 |
| | 31 | 13 | 20 | 32.39 | -6 | 13 | 06.4 | 1.129 508 | 7.79 | 2.97 | 10 | 43 | 06 |
| Nov | 1 | 13 | 25 | 55.29 | 6 | 47 | 17.2 | 1.152 643 | 7.63 | 2.92 | 10 | 44 | 36 |
| | 2 | 13 | 31 | 26.41 | 7 | 22 | 37.9 | 1.174 820 | 7.49 | 2.86 | 10 | 46 | 14 |
| | 3 | 13 | 37 | 04.51 | 7 | 58 | 53.2 | 1.196 021 | 7.35 | 2.81 | 10 | 47 | 59 |
| | 4 | 13 | 42 | 48.53 | 8 | 35 | 49.4 | 1.216 236 | 7.23 | 2.76 | 10 | 49 | 49 |
| | 5 | 13 | 48 | 37.59 | 9 | 13 | 14.3 | 1.235 467 | 7.12 | 2.72 | 10 | 51 | 43 |
| | 6 | 13 | 54 | 30.94 | -9 | 50 | 57.1 | 1.253 722 | 7.01 | 2.68 | 10 | 53 | 42 |
| | 7 | 14 | 00 | 27.97 | 10 | 28 | 48.5 | 1.271 013 | 6.92 | 2.64 | 10 | 55 | 44 |
| | 8 | 14 | 06 | 28.17 | 11 | 06 | 39.9 | 1.287 360 | 6.83 | 2.61 | 10 | 57 | 49 |
| | 9 | 14 | 12 | 31.12 | 11 | 44 | 24.1 | 1.302 782 | 6.75 | 2.58 | 10 | 59 | 57 |
| | 10 | 14 | 18 | 36.48 | 12 | 21 | 54.6 | 1.317 304 | 6.68 | 2.55 | 11 | 02 | 07 |
| | 11 | 14 | 24 | 44.00 | 12 | 59 | 05.7 | 1.330 947 | 6.61 | 2.52 | 11 | 04 | 19 |
| | 12 | 14 | 30 | 53.47 | -13 | 35 | 52.4 | 1.343 738 | 6.54 | 2.50 | 11 | 06 | 33 |
| | 13 | 14 | 37 | 04.72 | 14 | 12 | 10.1 | 1.355 700 | 6.49 | 2.48 | 11 | 08 | 49 |
| | 14 | 14 | 43 | 17.65 | 14 | 47 | 55.0 | 1.366 857 | 6.43 | 2.46 | 11 | 11 | 06 |
| | 15 | 14 | 49 | 32.17 | 15 | 23 | 03.5 | 1.377 232 | 6.39 | 2.44 | 11 | 13 | 25 |
| | 16 | 14 | 55 | 48.22 | -15 | 57 | 32.5 | 1.386 849 | 6.34 | 2.42 | 11 | 15 | 46 |

**MERCURY, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Nov | 16 | 14 | 55 | 48.22 | -15 | 57 | 32.5 | 1.386 849 | 6.34 | 2.42 | 11 | 15 | 46 |
| | 17 | 15 | 02 | 05.77 | 16 | 31 | 19.0 | 1.395 727 | 6.30 | 2.41 | 11 | 18 | 07 |
| | 18 | 15 | 08 | 24.81 | 17 | 04 | 20.6 | 1.403 887 | 6.26 | 2.39 | 11 | 20 | 31 |
| | 19 | 15 | 14 | 45.33 | 17 | 36 | 34.8 | 1.411 349 | 6.23 | 2.38 | 11 | 22 | 56 |
| | 20 | 15 | 21 | 07.34 | 18 | 07 | 59.5 | 1.418 129 | 6.20 | 2.37 | 11 | 25 | 22 |
| | 21 | 15 | 27 | 30.86 | 18 | 38 | 32.6 | 1.424 244 | 6.17 | 2.36 | 11 | 27 | 50 |
| | 22 | 15 | 33 | 55.89 | -19 | 08 | 12.2 | 1.429 709 | 6.15 | 2.35 | 11 | 30 | 20 |
| | 23 | 15 | 40 | 22.48 | 19 | 36 | 56.5 | 1.434 536 | 6.13 | 2.34 | 11 | 32 | 51 |
| | 24 | 15 | 46 | 50.64 | 20 | 04 | 43.9 | 1.438 740 | 6.11 | 2.34 | 11 | 35 | 23 |
| | 25 | 15 | 53 | 20.40 | 20 | 31 | 32.7 | 1.442 330 | 6.10 | 2.33 | 11 | 37 | 58 |
| | 26 | 15 | 59 | 51.77 | 20 | 57 | 21.3 | 1.445 316 | 6.08 | 2.32 | 11 | 40 | 33 |
| | 27 | 16 | 06 | 24.80 | 21 | 22 | 08.2 | 1.447 706 | 6.07 | 2.32 | 11 | 43 | 11 |
| | 28 | 16 | 12 | 59.48 | -21 | 45 | 52.0 | 1.449 508 | 6.07 | 2.32 | 11 | 45 | 50 |
| | 29 | 16 | 19 | 35.85 | 22 | 08 | 31.2 | 1.450 729 | 6.06 | 2.32 | 11 | 48 | 31 |
| | 30 | 16 | 26 | 13.91 | 22 | 30 | 04.1 | 1.451 371 | 6.06 | 2.32 | 11 | 51 | 14 |
| Dec | 1 | 16 | 32 | 53.65 | 22 | 50 | 29.5 | 1.451 441 | 6.06 | 2.31 | 11 | 53 | 58 |
| | 2 | 16 | 39 | 35.07 | 23 | 09 | 46.0 | 1.450 939 | 6.06 | 2.32 | 11 | 56 | 44 |
| | 3 | 16 | 46 | 18.16 | 23 | 27 | 52.3 | 1.449 867 | 6.07 | 2.32 | 11 | 59 | 32 |
| | 4 | 16 | 53 | 02.89 | -23 | 44 | 46.9 | 1.448 226 | 6.07 | 2.32 | 12 | 02 | 21 |
| | 5 | 16 | 59 | 49.22 | 24 | 00 | 28.6 | 1.446 015 | 6.08 | 2.32 | 12 | 05 | 12 |
| | 6 | 17 | 06 | 37.11 | 24 | 14 | 55.9 | 1.443 233 | 6.09 | 2.33 | 12 | 08 | 04 |
| | 7 | 17 | 13 | 26.49 | 24 | 28 | 07.4 | 1.439 877 | 6.11 | 2.33 | 12 | 10 | 58 |
| | 8 | 17 | 20 | 17.30 | 24 | 40 | 02.0 | 1.435 943 | 6.12 | 2.34 | 12 | 13 | 54 |
| | 9 | 17 | 27 | 09.43 | 24 | 50 | 38.1 | 1.431 427 | 6.14 | 2.35 | 12 | 16 | 50 |
| | 10 | 17 | 34 | 02.81 | -24 | 59 | 54.5 | 1.426 324 | 6.17 | 2.36 | 12 | 19 | 48 |
| | 11 | 17 | 40 | 57.32 | 25 | 07 | 50.0 | 1.420 626 | 6.19 | 2.37 | 12 | 22 | 47 |
| | 12 | 17 | 47 | 52.83 | 25 | 14 | 23.2 | 1.414 326 | 6.22 | 2.38 | 12 | 25 | 47 |
| | 13 | 17 | 54 | 49.21 | 25 | 19 | 32.9 | 1.407 415 | 6.25 | 2.39 | 12 | 28 | 47 |
| | 14 | 18 | 01 | 46.30 | 25 | 23 | 18.0 | 1.399 882 | 6.28 | 2.40 | 12 | 31 | 48 |
| | 15 | 18 | 08 | 43.90 | 25 | 25 | 37.4 | 1.391 718 | 6.32 | 2.41 | 12 | 34 | 50 |
| | 16 | 18 | 15 | 41.83 | -25 | 26 | 29.9 | 1.382 909 | 6.36 | 2.43 | 12 | 37 | 52 |
| | 17 | 18 | 22 | 39.85 | 25 | 25 | 54.7 | 1.373 442 | 6.40 | 2.45 | 12 | 40 | 54 |
| | 18 | 18 | 29 | 37.70 | 25 | 23 | 50.7 | 1.363 303 | 6.45 | 2.46 | 12 | 43 | 55 |
| | 19 | 18 | 36 | 35.09 | 25 | 20 | 17.2 | 1.352 476 | 6.50 | 2.48 | 12 | 46 | 56 |
| | 20 | 18 | 43 | 31.71 | 25 | 15 | 13.4 | 1.340 947 | 6.56 | 2.51 | 12 | 49 | 56 |
| | 21 | 18 | 50 | 27.19 | 25 | 08 | 39.0 | 1.328 697 | 6.62 | 2.53 | 12 | 52 | 54 |
| | 22 | 18 | 57 | 21.14 | -25 | 00 | 33.4 | 1.315 709 | 6.68 | 2.55 | 12 | 55 | 51 |
| | 23 | 19 | 04 | 13.10 | 24 | 50 | 56.7 | 1.301 965 | 6.75 | 2.58 | 12 | 58 | 46 |
| | 24 | 19 | 11 | 02.56 | 24 | 39 | 48.7 | 1.287 447 | 6.83 | 2.61 | 13 | 01 | 37 |
| | 25 | 19 | 17 | 48.97 | 24 | 27 | 10.1 | 1.272 137 | 6.91 | 2.64 | 13 | 04 | 26 |
| | 26 | 19 | 24 | 31.68 | 24 | 13 | 01.5 | 1.256 018 | 7.00 | 2.68 | 13 | 07 | 10 |
| | 27 | 19 | 31 | 09.97 | 23 | 57 | 24.1 | 1.239 072 | 7.10 | 2.71 | 13 | 09 | 49 |
| | 28 | 19 | 37 | 43.03 | -23 | 40 | 19.6 | 1.221 287 | 7.20 | 2.75 | 13 | 12 | 22 |
| | 29 | 19 | 44 | 09.95 | 23 | 21 | 50.3 | 1.202 648 | 7.31 | 2.79 | 13 | 14 | 49 |
| | 30 | 19 | 50 | 29.68 | 23 | 01 | 59.2 | 1.183 148 | 7.43 | 2.84 | 13 | 17 | 08 |
| | 31 | 19 | 56 | 41.06 | 22 | 40 | 49.9 | 1.162 784 | 7.56 | 2.89 | 13 | 19 | 18 |
| | 32 | 20 | 02 | 42.75 | -22 | 18 | 27.3 | 1.141 556 | 7.70 | 2.94 | 13 | 21 | 17 |

**VENUS, 2021**

HELIOCENTRIC POSITIONS FOR $0^h$ TERRESTRIAL TIME

MEAN EQUINOX AND ECLIPTIC OF DATE

| Date | Heliocentric Longitude ° ′ ″ | Heliocentric Latitude ° ′ ″ | Radius Vector | Date | Heliocentric Longitude ° ′ ″ | Heliocentric Latitude ° ′ ″ | Radius Vector |
|---|---|---|---|---|---|---|---|
| Jan. 1 | 232 13 18.0 | +1 25 02.1 | 0.724 1620 | Apr. 3 | 18 08 56.6 | -2 54 08.8 | 0.725 3033 |
| 3 | 235 24 48.6 | 1 14 35.3 | 0.724 4308 | 5 | 21 20 21.6 | 2 48 00.0 | 0.725 0497 |
| 5 | 238 36 09.2 | 1 03 55.1 | 0.724 6960 | 7 | 24 31 52.6 | 2 41 19.7 | 0.724 7906 |
| 7 | 241 47 20.2 | 0 53 03.5 | 0.724 9569 | 9 | 27 43 29.8 | 2 34 09.1 | 0.724 5268 |
| 9 | 244 58 21.8 | 0 42 02.5 | 0.725 2126 | 11 | 30 55 13.1 | 2 26 29.5 | 0.724 2592 |
| 11 | 248 09 14.6 | 0 30 54.3 | 0.725 4624 | 13 | 34 07 02.8 | 2 18 22.2 | 0.723 9887 |
| 13 | 251 19 58.9 | +0 19 40.8 | 0.725 7054 | 15 | 37 18 58.8 | -2 09 48.7 | 0.723 7159 |
| 15 | 254 30 35.3 | +0 08 24.1 | 0.725 9410 | 17 | 40 31 01.3 | 2 00 50.5 | 0.723 4418 |
| 17 | 257 41 04.1 | -0 02 53.8 | 0.726 1684 | 19 | 43 43 10.5 | 1 51 29.4 | 0.723 1673 |
| 19 | 260 51 26.1 | 0 14 10.6 | 0.726 3869 | 21 | 46 55 26.3 | 1 41 46.8 | 0.722 8931 |
| 21 | 264 01 41.6 | 0 25 24.5 | 0.726 5959 | 23 | 50 07 48.8 | 1 31 44.8 | 0.722 6202 |
| 23 | 267 11 51.3 | 0 36 33.3 | 0.726 7947 | 25 | 53 20 18.3 | 1 21 25.0 | 0.722 3494 |
| 25 | 270 21 55.6 | -0 47 35.1 | 0.726 9827 | 27 | 56 32 54.7 | -1 10 49.5 | 0.722 0815 |
| 27 | 273 31 55.3 | 0 58 27.8 | 0.727 1594 | 29 | 59 45 38.1 | 1 00 00.1 | 0.721 8175 |
| 29 | 276 41 50.8 | 1 09 09.5 | 0.727 3242 | May 1 | 62 58 28.6 | 0 48 59.0 | 0.721 5581 |
| 31 | 279 51 42.8 | 1 19 38.3 | 0.727 4766 | 3 | 66 11 26.4 | 0 37 48.1 | 0.721 3042 |
| Feb. 2 | 283 01 31.8 | 1 29 52.3 | 0.727 6162 | 5 | 69 24 31.3 | 0 26 29.7 | 0.721 0565 |
| 4 | 286 11 18.3 | 1 39 49.6 | 0.727 7425 | 7 | 72 37 43.5 | 0 15 05.7 | 0.720 8159 |
| 6 | 289 21 03.1 | -1 49 28.5 | 0.727 8552 | 9 | 75 51 03.0 | -0 03 38.4 | 0.720 5831 |
| 8 | 292 30 46.5 | 1 58 47.2 | 0.727 9540 | 11 | 79 04 29.7 | +0 07 50.0 | 0.720 3590 |
| 10 | 295 40 29.1 | 2 07 44.2 | 0.728 0385 | 13 | 82 18 03.7 | 0 19 17.3 | 0.720 1441 |
| 12 | 298 50 11.5 | 2 16 17.7 | 0.728 1085 | 15 | 85 31 45.0 | 0 30 41.3 | 0.719 9392 |
| 14 | 301 59 54.1 | 2 24 26.2 | 0.728 1637 | 17 | 88 45 33.3 | 0 41 59.9 | 0.719 7449 |
| 16 | 305 09 37.5 | 2 32 08.3 | 0.728 2041 | 19 | 91 59 28.7 | 0 53 10.8 | 0.719 5619 |
| 18 | 308 19 22.0 | -2 39 22.6 | 0.728 2294 | 21 | 95 13 31.0 | +1 04 11.9 | 0.719 3908 |
| 20 | 311 29 08.1 | 2 46 07.9 | 0.728 2397 | 23 | 98 27 40.0 | 1 15 01.1 | 0.719 2321 |
| 22 | 314 38 56.2 | 2 52 22.8 | 0.728 2349 | 25 | 101 41 55.5 | 1 25 36.1 | 0.719 0864 |
| 24 | 317 48 46.6 | 2 58 06.2 | 0.728 2149 | 27 | 104 56 17.3 | 1 35 55.0 | 0.718 9540 |
| 26 | 320 58 39.8 | 3 03 17.1 | 0.728 1799 | 29 | 108 10 45.1 | 1 45 55.7 | 0.718 8355 |
| 28 | 324 08 36.1 | 3 07 54.6 | 0.728 1300 | 31 | 111 25 18.5 | 1 55 36.3 | 0.718 7312 |
| Mar. 2 | 327 18 35.7 | -3 11 57.8 | 0.728 0653 | June 2 | 114 39 57.3 | +2 04 54.8 | 0.718 6415 |
| 4 | 330 28 39.0 | 3 15 25.9 | 0.727 9860 | 4 | 117 54 41.0 | 2 13 49.4 | 0.718 5666 |
| 6 | 333 38 46.1 | 3 18 18.2 | 0.727 8924 | 6 | 121 09 29.2 | 2 22 18.4 | 0.718 5069 |
| 8 | 336 48 57.4 | 3 20 34.4 | 0.727 7847 | 8 | 124 24 21.5 | 2 30 20.1 | 0.718 4624 |
| 10 | 339 59 13.1 | 3 22 13.7 | 0.727 6632 | 10 | 127 39 17.2 | 2 37 52.9 | 0.718 4334 |
| 12 | 343 09 33.4 | 3 23 16.1 | 0.727 5283 | 12 | 130 54 15.9 | 2 44 55.3 | 0.718 4199 |
| 14 | 346 19 58.3 | -3 23 41.1 | 0.727 3804 | 14 | 134 09 17.0 | +2 51 25.9 | 0.718 4219 |
| 16 | 349 30 28.1 | 3 23 28.8 | 0.727 2200 | 16 | 137 24 19.9 | 2 57 23.4 | 0.718 4396 |
| 18 | 352 41 03.0 | 3 22 39.0 | 0.727 0476 | 18 | 140 39 24.0 | 3 02 46.8 | 0.718 4728 |
| 20 | 355 51 43.0 | 3 21 11.9 | 0.726 8636 | 20 | 143 54 28.6 | 3 07 34.9 | 0.718 5213 |
| 22 | 359 02 28.3 | 3 19 07.7 | 0.726 6686 | 22 | 147 09 33.1 | 3 11 46.7 | 0.718 5852 |
| 24 | 2 13 19.0 | 3 16 26.7 | 0.726 4632 | 24 | 150 24 36.6 | 3 15 21.6 | 0.718 6640 |
| 26 | 5 24 15.1 | -3 13 09.3 | 0.726 2481 | 26 | 153 39 38.7 | +3 18 18.8 | 0.718 7577 |
| 28 | 8 35 16.9 | 3 09 16.1 | 0.726 0238 | 28 | 156 54 38.5 | 3 20 37.7 | 0.718 8658 |
| 30 | 11 46 24.3 | 3 04 47.8 | 0.725 7911 | 30 | 160 09 35.3 | 3 22 18.0 | 0.718 9881 |
| Apr. 1 | 14 57 37.5 | 2 59 45.1 | 0.725 5507 | July 2 | 163 24 28.4 | 3 23 19.4 | 0.719 1241 |
| 3 | 18 08 56.6 | -2 54 08.8 | 0.725 3033 | 4 | 166 39 17.2 | +3 23 41.6 | 0.719 2733 |

**VENUS, 2021**
HELIOCENTRIC POSITIONS FOR $0^h$ TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

| Date | | Heliocentric Longitude | | | Heliocentric Latitude | | | Radius Vector | Date | | Heliocentric Longitude | | | Heliocentric Latitude | | | Radius Vector |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | | ° | ' | " | ° | ' | " | |
| July | 2 | 163 | 24 | 28.4 | +3 | 23 | 19.4 | 0.719 1241 | Oct. | 2 | 310 | 23 | 14.2 | -2 | 43 | 49.7 | 0.728 2293 |
| | 4 | 166 | 39 | 17.2 | 3 | 23 | 41.6 | 0.719 2733 | | 4 | 313 | 33 | 01.8 | 2 | 50 | 15.3 | 0.728 2295 |
| | 6 | 169 | 54 | 01.0 | 3 | 23 | 24.7 | 0.719 4354 | | 6 | 316 | 42 | 51.7 | 2 | 56 | 09.9 | 0.728 2146 |
| | 8 | 173 | 08 | 39.0 | 3 | 22 | 28.8 | 0.719 6098 | | 8 | 319 | 52 | 44.1 | 3 | 01 | 32.3 | 0.728 1847 |
| | 10 | 176 | 23 | 10.7 | 3 | 20 | 54.1 | 0.719 7958 | | 10 | 323 | 02 | 39.5 | 3 | 06 | 21.6 | 0.728 1398 |
| | 12 | 179 | 37 | 35.4 | 3 | 18 | 40.9 | 0.719 9930 | | 12 | 326 | 12 | 38.2 | 3 | 10 | 36.8 | 0.728 0801 |
| | 14 | 182 | 51 | 52.6 | +3 | 15 | 49.9 | 0.720 2007 | | 14 | 329 | 22 | 40.5 | -3 | 14 | 17.2 | 0.728 0057 |
| | 16 | 186 | 06 | 01.7 | 3 | 12 | 21.6 | 0.720 4181 | | 16 | 332 | 32 | 46.6 | 3 | 17 | 22.1 | 0.727 9169 |
| | 18 | 189 | 20 | 02.1 | 3 | 08 | 16.7 | 0.720 6447 | | 18 | 335 | 42 | 56.7 | 3 | 19 | 51.0 | 0.727 8139 |
| | 20 | 192 | 33 | 53.5 | 3 | 03 | 36.1 | 0.720 8796 | | 20 | 338 | 53 | 11.1 | 3 | 21 | 43.2 | 0.727 6971 |
| | 22 | 195 | 47 | 35.3 | 2 | 58 | 20.8 | 0.721 1222 | | 22 | 342 | 03 | 30.0 | 3 | 22 | 58.5 | 0.727 5668 |
| | 24 | 199 | 01 | 07.3 | 2 | 52 | 31.8 | 0.721 3717 | | 24 | 345 | 13 | 53.6 | 3 | 23 | 36.6 | 0.727 4234 |
| | 26 | 202 | 14 | 29.1 | +2 | 46 | 10.4 | 0.721 6271 | | 26 | 348 | 24 | 22.0 | -3 | 23 | 37.3 | 0.727 2673 |
| | 28 | 205 | 27 | 40.4 | 2 | 39 | 17.8 | 0.721 8879 | | 28 | 351 | 34 | 55.4 | 3 | 23 | 00.6 | 0.727 0991 |
| | 30 | 208 | 40 | 41.1 | 2 | 31 | 55.4 | 0.722 1530 | | 30 | 354 | 45 | 33.9 | 3 | 21 | 46.5 | 0.726 9191 |
| Aug. | 1 | 211 | 53 | 31.0 | 2 | 24 | 04.7 | 0.722 4218 | Nov. | 1 | 357 | 56 | 17.6 | 3 | 19 | 55.2 | 0.726 7280 |
| | 3 | 215 | 06 | 09.9 | 2 | 15 | 47.2 | 0.722 6932 | | 3 | 1 | 07 | 06.7 | 3 | 17 | 27.0 | 0.726 5263 |
| | 5 | 218 | 18 | 37.8 | 2 | 07 | 04.6 | 0.722 9665 | | 5 | 4 | 18 | 01.3 | 3 | 14 | 22.2 | 0.726 3146 |
| | 7 | 221 | 30 | 54.8 | +1 | 57 | 58.5 | 0.723 2409 | | 7 | 7 | 29 | 01.4 | -3 | 10 | 41.5 | 0.726 0937 |
| | 9 | 224 | 43 | 00.9 | 1 | 48 | 30.8 | 0.723 5154 | | 9 | 10 | 40 | 07.1 | 3 | 06 | 25.3 | 0.725 8641 |
| | 11 | 227 | 54 | 56.3 | 1 | 38 | 43.2 | 0.723 7891 | | 11 | 13 | 51 | 18.6 | 3 | 01 | 34.5 | 0.725 6266 |
| | 13 | 231 | 06 | 41.0 | 1 | 28 | 37.6 | 0.724 0614 | | 13 | 17 | 02 | 35.9 | 2 | 56 | 09.8 | 0.725 3818 |
| | 15 | 234 | 18 | 15.3 | 1 | 18 | 16.0 | 0.724 3312 | | 15 | 20 | 13 | 59.1 | 2 | 50 | 12.2 | 0.725 1306 |
| | 17 | 237 | 29 | 39.6 | 1 | 07 | 40.2 | 0.724 5977 | | 17 | 23 | 25 | 28.3 | 2 | 43 | 42.8 | 0.724 8737 |
| | 19 | 240 | 40 | 54.0 | +0 | 56 | 52.4 | 0.724 8602 | | 19 | 26 | 37 | 03.5 | -2 | 36 | 42.6 | 0.724 6119 |
| | 21 | 243 | 51 | 59.1 | 0 | 45 | 54.5 | 0.725 1178 | | 21 | 29 | 48 | 44.9 | 2 | 29 | 12.9 | 0.724 3460 |
| | 23 | 247 | 02 | 55.1 | 0 | 34 | 48.5 | 0.725 3697 | | 23 | 33 | 00 | 32.6 | 2 | 21 | 15.1 | 0.724 0769 |
| | 25 | 250 | 13 | 42.5 | 0 | 23 | 36.6 | 0.725 6151 | | 25 | 36 | 12 | 26.6 | 2 | 12 | 50.5 | 0.723 8053 |
| | 27 | 253 | 24 | 21.7 | 0 | 12 | 20.8 | 0.725 8534 | | 27 | 39 | 24 | 27.1 | 2 | 04 | 00.7 | 0.723 5321 |
| | 29 | 256 | 34 | 53.3 | +0 | 01 | 03.1 | 0.726 0836 | | 29 | 42 | 36 | 34.1 | 1 | 54 | 47.4 | 0.723 2582 |
| | 31 | 259 | 45 | 17.7 | -0 | 10 | 14.4 | 0.726 3053 | Dec. | 1 | 45 | 48 | 47.7 | -1 | 45 | 12.1 | 0.722 9844 |
| Sept. | 2 | 262 | 55 | 35.6 | 0 | 21 | 29.5 | 0.726 5176 | | 3 | 49 | 01 | 08.1 | 1 | 35 | 16.6 | 0.722 7116 |
| | 4 | 266 | 05 | 47.4 | 0 | 32 | 40.3 | 0.726 7200 | | 5 | 52 | 13 | 35.2 | 1 | 25 | 02.8 | 0.722 4406 |
| | 6 | 269 | 15 | 53.7 | 0 | 43 | 44.8 | 0.726 9118 | | 7 | 55 | 26 | 09.3 | 1 | 14 | 32.6 | 0.722 1723 |
| | 8 | 272 | 25 | 55.1 | 0 | 54 | 40.9 | 0.727 0924 | | 9 | 58 | 38 | 50.4 | 1 | 03 | 47.8 | 0.721 9076 |
| | 10 | 275 | 35 | 52.2 | 1 | 05 | 26.7 | 0.727 2613 | | 11 | 61 | 51 | 38.5 | 0 | 52 | 50.6 | 0.721 6472 |
| | 12 | 278 | 45 | 45.5 | -1 | 16 | 00.2 | 0.727 4180 | | 13 | 65 | 04 | 33.8 | -0 | 41 | 42.8 | 0.721 3921 |
| | 14 | 281 | 55 | 35.7 | 1 | 26 | 19.6 | 0.727 5620 | | 15 | 68 | 17 | 36.2 | 0 | 30 | 26.8 | 0.721 1430 |
| | 16 | 285 | 05 | 23.2 | 1 | 36 | 22.9 | 0.727 6929 | | 17 | 71 | 30 | 45.9 | 0 | 19 | 04.5 | 0.720 9007 |
| | 18 | 288 | 15 | 08.7 | 1 | 46 | 08.5 | 0.727 8102 | | 19 | 74 | 44 | 02.8 | -0 | 07 | 38.1 | 0.720 6660 |
| | 20 | 291 | 24 | 52.7 | 1 | 55 | 34.5 | 0.727 9137 | | 21 | 77 | 57 | 27.0 | +0 | 03 | 50.1 | 0.720 4396 |
| | 22 | 294 | 34 | 35.7 | 2 | 04 | 39.2 | 0.728 0030 | | 23 | 81 | 10 | 58.5 | 0 | 15 | 18.1 | 0.720 2224 |
| | 24 | 297 | 44 | 18.3 | -2 | 13 | 21.1 | 0.728 0779 | | 25 | 84 | 24 | 37.1 | +0 | 26 | 43.5 | 0.720 0149 |
| | 26 | 300 | 54 | 01.0 | 2 | 21 | 38.5 | 0.728 1381 | | 27 | 87 | 38 | 22.8 | 0 | 38 | 04.3 | 0.719 8179 |
| | 28 | 304 | 03 | 44.3 | 2 | 29 | 30.0 | 0.728 1835 | | 29 | 90 | 52 | 15.7 | 0 | 49 | 18.1 | 0.719 6320 |
| | 30 | 307 | 13 | 28.5 | 2 | 36 | 54.2 | 0.728 2139 | | 31 | 94 | 06 | 15.4 | 1 | 00 | 22.8 | 0.719 4578 |
| Oct. | 2 | 310 | 23 | 14.2 | -2 | 43 | 49.7 | 0.728 2293 | | 33 | 97 | 20 | 21.9 | +1 | 11 | 16.4 | 0.719 2959 |

**VENUS, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| Jan. | 0 | 259 | 09 | 28.9 | +0 | 41 | 58.0 | Feb. | 15 | 316 | 48 | 04.9 | -1 | 04 | 11.6 |
| | 1 | 260 | 24 | 36.8 | 0 | 39 | 29.9 | | 16 | 318 | 03 | 11.6 | 1 | 05 | 45.9 |
| | 2 | 261 | 39 | 45.3 | 0 | 37 | 00.7 | | 17 | 319 | 18 | 17.7 | 1 | 07 | 17.1 |
| | 3 | 262 | 54 | 54.4 | 0 | 34 | 30.5 | | 18 | 320 | 33 | 23.2 | 1 | 08 | 45.0 |
| | 4 | 264 | 10 | 04.0 | 0 | 31 | 59.4 | | 19 | 321 | 48 | 28.1 | 1 | 10 | 09.7 |
| | 5 | 265 | 25 | 14.1 | 0 | 29 | 27.5 | | 20 | 323 | 03 | 32.3 | 1 | 11 | 31.1 |
| | 6 | 266 | 40 | 24.8 | +0 | 26 | 54.9 | | 21 | 324 | 18 | 35.8 | -1 | 12 | 49.2 |
| | 7 | 267 | 55 | 36.0 | 0 | 24 | 21.7 | | 22 | 325 | 33 | 38.7 | 1 | 14 | 03.9 |
| | 8 | 269 | 10 | 47.7 | 0 | 21 | 48.0 | | 23 | 326 | 48 | 40.8 | 1 | 15 | 15.1 |
| | 9 | 270 | 25 | 59.9 | 0 | 19 | 14.0 | | 24 | 328 | 03 | 42.2 | 1 | 16 | 22.8 |
| | 10 | 271 | 41 | 12.5 | 0 | 16 | 39.8 | | 25 | 329 | 18 | 42.9 | 1 | 17 | 27.1 |
| | 11 | 272 | 56 | 25.5 | 0 | 14 | 05.4 | | 26 | 330 | 33 | 42.9 | 1 | 18 | 27.8 |
| | 12 | 274 | 11 | 38.8 | +0 | 11 | 31.0 | | 27 | 331 | 48 | 42.1 | -1 | 19 | 24.9 |
| | 13 | 275 | 26 | 52.2 | 0 | 08 | 56.8 | | 28 | 333 | 03 | 40.6 | 1 | 20 | 18.4 |
| | 14 | 276 | 42 | 05.6 | 0 | 06 | 22.7 | Mar. | 1 | 334 | 18 | 38.4 | 1 | 21 | 08.3 |
| | 15 | 277 | 57 | 19.1 | 0 | 03 | 48.9 | | 2 | 335 | 33 | 35.6 | 1 | 21 | 54.4 |
| | 16 | 279 | 12 | 32.5 | +0 | 01 | 15.6 | | 3 | 336 | 48 | 32.2 | 1 | 22 | 36.9 |
| | 17 | 280 | 27 | 45.8 | -0 | 01 | 17.2 | | 4 | 338 | 03 | 28.4 | 1 | 23 | 15.7 |
| | 18 | 281 | 42 | 59.0 | -0 | 03 | 49.4 | | 5 | 339 | 18 | 24.0 | -1 | 23 | 50.7 |
| | 19 | 282 | 58 | 12.0 | 0 | 06 | 20.8 | | 6 | 340 | 33 | 19.0 | 1 | 24 | 21.9 |
| | 20 | 284 | 13 | 25.0 | 0 | 08 | 51.4 | | 7 | 341 | 48 | 13.6 | 1 | 24 | 49.3 |
| | 21 | 285 | 28 | 37.7 | 0 | 11 | 21.1 | | 8 | 343 | 03 | 07.5 | 1 | 25 | 12.9 |
| | 22 | 286 | 43 | 50.4 | 0 | 13 | 49.7 | | 9 | 344 | 18 | 00.7 | 1 | 25 | 32.7 |
| | 23 | 287 | 59 | 02.9 | 0 | 16 | 17.2 | | 10 | 345 | 32 | 53.2 | 1 | 25 | 48.6 |
| | 24 | 289 | 14 | 15.2 | -0 | 18 | 43.5 | | 11 | 346 | 47 | 44.9 | -1 | 26 | 00.7 |
| | 25 | 290 | 29 | 27.4 | 0 | 21 | 08.4 | | 12 | 348 | 02 | 35.7 | 1 | 26 | 09.0 |
| | 26 | 291 | 44 | 39.5 | 0 | 23 | 31.9 | | 13 | 349 | 17 | 25.8 | 1 | 26 | 13.3 |
| | 27 | 292 | 59 | 51.4 | 0 | 25 | 54.0 | | 14 | 350 | 32 | 14.9 | 1 | 26 | 13.8 |
| | 28 | 294 | 15 | 03.1 | 0 | 28 | 14.4 | | 15 | 351 | 47 | 03.1 | 1 | 26 | 10.5 |
| | 29 | 295 | 30 | 14.6 | 0 | 30 | 33.1 | | 16 | 353 | 01 | 50.3 | 1 | 26 | 03.3 |
| | 30 | 296 | 45 | 25.9 | -0 | 32 | 50.1 | | 17 | 354 | 16 | 36.6 | -1 | 25 | 52.3 |
| | 31 | 298 | 00 | 37.1 | 0 | 35 | 05.2 | | 18 | 355 | 31 | 22.0 | 1 | 25 | 37.4 |
| Feb. | 1 | 299 | 15 | 48.1 | 0 | 37 | 18.3 | | 19 | 356 | 46 | 06.3 | 1 | 25 | 18.7 |
| | 2 | 300 | 30 | 59.1 | 0 | 39 | 29.4 | | 20 | 358 | 00 | 49.5 | 1 | 24 | 56.2 |
| | 3 | 301 | 46 | 09.9 | 0 | 41 | 38.4 | | 21 | 359 | 15 | 31.7 | 1 | 24 | 30.0 |
| | 4 | 303 | 01 | 20.7 | 0 | 43 | 45.2 | | 22 | 0 | 30 | 12.8 | 1 | 23 | 59.9 |
| | 5 | 304 | 16 | 31.4 | -0 | 45 | 49.7 | | 23 | 1 | 44 | 52.8 | -1 | 23 | 26.2 |
| | 6 | 305 | 31 | 42.1 | 0 | 47 | 51.9 | | 24 | 2 | 59 | 31.6 | 1 | 22 | 48.8 |
| | 7 | 306 | 46 | 52.7 | 0 | 49 | 51.6 | | 25 | 4 | 14 | 09.3 | 1 | 22 | 07.6 |
| | 8 | 308 | 02 | 03.1 | 0 | 51 | 48.7 | | 26 | 5 | 28 | 45.8 | 1 | 21 | 22.8 |
| | 9 | 309 | 17 | 13.2 | 0 | 53 | 43.3 | | 27 | 6 | 43 | 21.1 | 1 | 20 | 34.4 |
| | 10 | 310 | 32 | 23.0 | 0 | 55 | 35.1 | | 28 | 7 | 57 | 55.3 | 1 | 19 | 42.4 |
| | 11 | 311 | 47 | 32.4 | -0 | 57 | 24.2 | | 29 | 9 | 12 | 28.3 | -1 | 18 | 46.9 |
| | 12 | 313 | 02 | 41.3 | 0 | 59 | 10.5 | | 30 | 10 | 27 | 00.4 | 1 | 17 | 47.8 |
| | 13 | 314 | 17 | 49.8 | 1 | 00 | 53.9 | | 31 | 11 | 41 | 31.4 | 1 | 16 | 45.3 |
| | 14 | 315 | 32 | 57.6 | 1 | 02 | 34.3 | Apr. | 1 | 12 | 56 | 01.6 | 1 | 15 | 39.3 |
| | 15 | 316 | 48 | 04.9 | -1 | 04 | 11.6 | | 2 | 14 | 10 | 30.9 | -1 | 14 | 30.0 |

**VENUS, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| Apr. | 1 | 12 | 56 | 01.6 | -1 | 15 | 39.3 | May | 17 | 69 | 43 | 32.3 | +0 | 18 | 08.9 |
| | 2 | 14 | 10 | 30.9 | 1 | 14 | 30.0 | | 18 | 70 | 57 | 10.6 | 0 | 20 | 36.3 |
| | 3 | 15 | 24 | 59.3 | 1 | 13 | 17.3 | | 19 | 72 | 10 | 47.7 | 0 | 23 | 03.2 |
| | 4 | 16 | 39 | 26.8 | 1 | 12 | 01.3 | | 20 | 73 | 24 | 23.5 | 0 | 25 | 29.4 |
| | 5 | 17 | 53 | 53.4 | 1 | 10 | 42.0 | | 21 | 74 | 37 | 57.9 | 0 | 27 | 55.0 |
| | 6 | 19 | 08 | 19.0 | 1 | 09 | 19.6 | | 22 | 75 | 51 | 31.0 | 0 | 30 | 19.8 |
| | 7 | 20 | 22 | 43.6 | -1 | 07 | 53.9 | | 23 | 77 | 05 | 02.8 | +0 | 32 | 43.7 |
| | 8 | 21 | 37 | 07.1 | 1 | 06 | 25.2 | | 24 | 78 | 18 | 33.3 | 0 | 35 | 06.6 |
| | 9 | 22 | 51 | 29.7 | 1 | 04 | 53.5 | | 25 | 79 | 32 | 02.6 | 0 | 37 | 28.4 |
| | 10 | 24 | 05 | 51.2 | 1 | 03 | 18.7 | | 26 | 80 | 45 | 30.7 | 0 | 39 | 49.0 |
| | 11 | 25 | 20 | 11.6 | 1 | 01 | 41.1 | | 27 | 81 | 58 | 57.7 | 0 | 42 | 08.3 |
| | 12 | 26 | 34 | 30.9 | -1 | 00 | 00.5 | | 28 | 83 | 12 | 23.6 | 0 | 44 | 26.2 |
| | 13 | 27 | 48 | 49.2 | -0 | 58 | 17.3 | | 29 | 84 | 25 | 48.4 | +0 | 46 | 42.6 |
| | 14 | 29 | 03 | 06.4 | 0 | 56 | 31.3 | | 30 | 85 | 39 | 12.0 | 0 | 48 | 57.4 |
| | 15 | 30 | 17 | 22.4 | 0 | 54 | 42.6 | | 31 | 86 | 52 | 34.6 | 0 | 51 | 10.5 |
| | 16 | 31 | 31 | 37.2 | 0 | 52 | 51.4 | June | 1 | 88 | 05 | 56.1 | 0 | 53 | 21.9 |
| | 17 | 32 | 45 | 50.9 | 0 | 50 | 57.7 | | 2 | 89 | 19 | 16.5 | 0 | 55 | 31.3 |
| | 18 | 34 | 00 | 03.3 | 0 | 49 | 01.6 | | 3 | 90 | 32 | 35.9 | 0 | 57 | 38.9 |
| | 19 | 35 | 14 | 14.5 | -0 | 47 | 03.2 | | 4 | 91 | 45 | 54.3 | +0 | 59 | 44.3 |
| | 20 | 36 | 28 | 24.4 | 0 | 45 | 02.5 | | 5 | 92 | 59 | 11.7 | 1 | 01 | 47.6 |
| | 21 | 37 | 42 | 32.9 | 0 | 42 | 59.6 | | 6 | 94 | 12 | 28.1 | 1 | 03 | 48.6 |
| | 22 | 38 | 56 | 40.1 | 0 | 40 | 54.7 | | 7 | 95 | 25 | 43.5 | 1 | 05 | 47.3 |
| | 23 | 40 | 10 | 46.0 | 0 | 38 | 47.7 | | 8 | 96 | 38 | 57.8 | 1 | 07 | 43.5 |
| | 24 | 41 | 24 | 50.5 | 0 | 36 | 38.8 | | 9 | 97 | 52 | 11.2 | 1 | 09 | 37.2 |
| | 25 | 42 | 38 | 53.6 | -0 | 34 | 28.1 | | 10 | 99 | 05 | 23.4 | +1 | 11 | 28.2 |
| | 26 | 43 | 52 | 55.6 | 0 | 32 | 15.7 | | 11 | 100 | 18 | 34.6 | 1 | 13 | 16.5 |
| | 27 | 45 | 06 | 56.3 | 0 | 30 | 01.6 | | 12 | 101 | 31 | 44.6 | 1 | 15 | 02.0 |
| | 28 | 46 | 20 | 55.9 | 0 | 27 | 45.9 | | 13 | 102 | 44 | 53.4 | 1 | 16 | 44.6 |
| | 29 | 47 | 34 | 54.5 | 0 | 25 | 28.8 | | 14 | 103 | 58 | 00.9 | 1 | 18 | 24.1 |
| | 30 | 48 | 48 | 52.0 | 0 | 23 | 10.2 | | 15 | 105 | 11 | 07.1 | 1 | 20 | 00.6 |
| May | 1 | 50 | 02 | 48.5 | -0 | 20 | 50.3 | | 16 | 106 | 24 | 11.8 | +1 | 21 | 33.9 |
| | 2 | 51 | 16 | 44.0 | 0 | 18 | 29.2 | | 17 | 107 | 37 | 15.2 | 1 | 23 | 04.0 |
| | 3 | 52 | 30 | 38.4 | 0 | 16 | 07.0 | | 18 | 108 | 50 | 17.1 | 1 | 24 | 30.7 |
| | 4 | 53 | 44 | 31.8 | 0 | 13 | 43.7 | | 19 | 110 | 03 | 17.5 | 1 | 25 | 54.0 |
| | 5 | 54 | 58 | 24.2 | 0 | 11 | 19.5 | | 20 | 111 | 16 | 16.4 | 1 | 27 | 13.8 |
| | 6 | 56 | 12 | 15.6 | 0 | 08 | 54.4 | | 21 | 112 | 29 | 13.8 | 1 | 28 | 30.1 |
| | 7 | 57 | 26 | 06.0 | -0 | 06 | 28.6 | | 22 | 113 | 42 | 09.7 | +1 | 29 | 42.7 |
| | 8 | 58 | 39 | 55.3 | 0 | 04 | 02.1 | | 23 | 114 | 55 | 04.1 | 1 | 30 | 51.6 |
| | 9 | 59 | 53 | 43.6 | 0 | 01 | 35.0 | | 24 | 116 | 07 | 57.1 | 1 | 31 | 56.7 |
| | 10 | 61 | 07 | 30.9 | -0 | 00 | 52.4 | | 25 | 117 | 20 | 48.6 | 1 | 32 | 58.1 |
| | 11 | 62 | 21 | 17.3 | +0 | 03 | 20.3 | | 26 | 118 | 33 | 38.5 | 1 | 33 | 55.5 |
| | 12 | 63 | 35 | 02.5 | 0 | 05 | 48.4 | | 27 | 119 | 46 | 27.0 | 1 | 34 | 48.9 |
| | | | | | | | | | | 120 | 59 | 13.9 | 1 | 35 | 38.4 |
| | 13 | 64 | 48 | 46.7 | +0 | 08 | 16.6 | | 28 | | | | | | |
| | 14 | 66 | 02 | 29.8 | 0 | 10 | 44.9 | | 29 | 122 | 11 | 59.4 | +1 | 36 | 23.8 |
| | 15 | 67 | 16 | 11.8 | 0 | 13 | 13.1 | | 30 | 123 | 24 | 43.4 | 1 | 37 | 05.1 |
| | 16 | 68 | 29 | 52.7 | 0 | 15 | 41.1 | July | 1 | 124 | 37 | 26.0 | 1 | 37 | 42.2 |
| | 17 | 69 | 43 | 32.3 | +0 | 18 | 08.9 | | 2 | 125 | 50 | 07.2 | +1 | 38 | 15.1 |

**VENUS, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| July | 1 | 124 | 37 | 26.0 | +1 | 37 | 42.2 | Aug. | 16 | 179 | 46 | 48.2 | +0 | 43 | 24.5 |
| | 2 | 125 | 50 | 07.2 | 1 | 38 | 15.1 | | 17 | 180 | 57 | 44.1 | 0 | 40 | 28.4 |
| | 3 | 127 | 02 | 47.0 | 1 | 38 | 43.7 | | 18 | 182 | 08 | 36.4 | 0 | 37 | 28.4 |
| | 4 | 128 | 15 | 25.4 | 1 | 39 | 08.0 | | 19 | 183 | 19 | 25.1 | 0 | 34 | 24.8 |
| | 5 | 129 | 28 | 02.3 | 1 | 39 | 27.9 | | 20 | 184 | 30 | 10.0 | 0 | 31 | 17.5 |
| | 6 | 130 | 40 | 37.9 | 1 | 39 | 43.3 | | 21 | 185 | 40 | 51.1 | 0 | 28 | 06.6 |
| | 7 | 131 | 53 | 12.0 | +1 | 39 | 54.3 | | 22 | 186 | 51 | 28.3 | +0 | 24 | 52.3 |
| | 8 | 133 | 05 | 44.6 | 1 | 40 | 00.8 | | 23 | 188 | 02 | 01.6 | 0 | 21 | 34.5 |
| | 9 | 134 | 18 | 15.6 | 1 | 40 | 02.7 | | 24 | 189 | 12 | 31.1 | 0 | 18 | 13.5 |
| | 10 | 135 | 30 | 45.0 | 1 | 40 | 00.1 | | 25 | 190 | 22 | 56.6 | 0 | 14 | 49.2 |
| | 11 | 136 | 43 | 12.6 | 1 | 39 | 52.8 | | 26 | 191 | 33 | 18.2 | 0 | 11 | 21.8 |
| | 12 | 137 | 55 | 38.6 | 1 | 39 | 40.9 | | 27 | 192 | 43 | 35.9 | 0 | 07 | 51.4 |
| | 13 | 139 | 08 | 02.6 | +1 | 39 | 24.3 | | 28 | 193 | 53 | 49.7 | +0 | 04 | 18.1 |
| | 14 | 140 | 20 | 24.8 | 1 | 39 | 02.9 | | 29 | 195 | 03 | 59.5 | +0 | 00 | 41.9 |
| | 15 | 141 | 32 | 44.9 | 1 | 38 | 36.9 | | 30 | 196 | 14 | 05.4 | 0 | 02 | 57.1 |
| | 16 | 142 | 45 | 03.0 | 1 | 38 | 06.1 | | 31 | 197 | 24 | 07.2 | 0 | 06 | 38.6 |
| | 17 | 143 | 57 | 19.0 | 1 | 37 | 30.5 | Sept. | 1 | 198 | 34 | 04.9 | 0 | 10 | 22.7 |
| | 18 | 145 | 09 | 32.9 | 1 | 36 | 50.1 | | 2 | 199 | 43 | 58.4 | 0 | 14 | 09.2 |
| | 19 | 146 | 21 | 44.6 | +1 | 36 | 05.0 | | 3 | 200 | 53 | 47.6 | +0 | 17 | 58.0 |
| | 20 | 147 | 33 | 54.1 | 1 | 35 | 15.0 | | 4 | 202 | 03 | 32.5 | -0 | 21 | 49.1 |
| | 21 | 148 | 46 | 01.4 | 1 | 34 | 20.2 | | 5 | 203 | 13 | 13.0 | 0 | 25 | 42.2 |
| | 22 | 149 | 58 | 06.3 | 1 | 33 | 20.7 | | 6 | 204 | 22 | 48.9 | 0 | 29 | 37.3 |
| | 23 | 151 | 10 | 08.9 | 1 | 32 | 16.4 | | 7 | 205 | 32 | 20.1 | 0 | 33 | 34.3 |
| | 24 | 152 | 22 | 09.1 | 1 | 31 | 07.3 | | 8 | 206 | 41 | 46.5 | 0 | 37 | 33.0 |
| | 25 | 153 | 34 | 06.9 | +1 | 29 | 53.4 | | 9 | 207 | 51 | 08.0 | -0 | 41 | 33.3 |
| | 26 | 154 | 46 | 02.2 | 1 | 28 | 34.7 | | 10 | 209 | 00 | 24.4 | 0 | 45 | 35.1 |
| | 27 | 155 | 57 | 55.1 | 1 | 27 | 11.3 | | 11 | 210 | 09 | 35.6 | 0 | 49 | 38.2 |
| | 28 | 157 | 09 | 45.7 | 1 | 25 | 43.2 | | 12 | 211 | 18 | 41.4 | 0 | 53 | 42.6 |
| | 29 | 158 | 21 | 33.9 | 1 | 24 | 10.3 | | 13 | 212 | 27 | 41.7 | 0 | 57 | 48.0 |
| | 30 | 159 | 33 | 19.8 | 1 | 22 | 32.7 | | 14 | 213 | 36 | 36.2 | 1 | 01 | 54.3 |
| | 31 | 160 | 45 | 03.4 | +1 | 20 | 50.5 | | 15 | 214 | 45 | 24.7 | -1 | 06 | 01.4 |
| Aug. | 1 | 161 | 56 | 44.6 | 1 | 19 | 03.6 | | 16 | 215 | 54 | 07.1 | 1 | 10 | 09.1 |
| | 2 | 163 | 08 | 23.4 | 1 | 17 | 12.1 | | 17 | 217 | 02 | 43.1 | 1 | 14 | 17.3 |
| | 3 | 164 | 19 | 59.9 | 1 | 15 | 15.9 | | 18 | 218 | 11 | 12.5 | 1 | 18 | 25.8 |
| | 4 | 165 | 31 | 34.0 | 1 | 13 | 15.2 | | 19 | 219 | 19 | 35.3 | 1 | 22 | 34.5 |
| | 5 | 166 | 43 | 05.5 | 1 | 11 | 09.9 | | 20 | 220 | 27 | 51.3 | 1 | 26 | 43.2 |
| | 6 | 167 | 54 | 34.6 | +1 | 09 | 00.1 | | 21 | 221 | 36 | 00.3 | -1 | 30 | 51.7 |
| | 7 | 169 | 06 | 01.0 | 1 | 06 | 45.9 | | 22 | 222 | 44 | 02.3 | 1 | 35 | 00.0 |
| | 8 | 170 | 17 | 24.8 | 1 | 04 | 27.2 | | 23 | 223 | 51 | 57.2 | 1 | 39 | 07.8 |
| | 9 | 171 | 28 | 45.8 | 1 | 02 | 04.2 | | 24 | 224 | 59 | 44.9 | 1 | 43 | 14.9 |
| | 10 | 172 | 40 | 04.0 | 0 | 59 | 36.8 | | 25 | 226 | 07 | 25.1 | 1 | 47 | 21.4 |
| | 11 | 173 | 51 | 19.2 | 0 | 57 | 05.1 | | 26 | 227 | 14 | 57.9 | 1 | 51 | 26.9 |
| | 12 | 175 | 02 | 31.3 | +0 | 54 | 29.2 | | 27 | 228 | 22 | 23.0 | -1 | 55 | 31.3 |
| | 13 | 176 | 13 | 40.4 | 0 | 51 | 49.1 | | 28 | 229 | 29 | 40.3 | 1 | 59 | 34.5 |
| | 14 | 177 | 24 | 46.3 | 0 | 49 | 04.9 | | 29 | 230 | 36 | 49.5 | 2 | 03 | 36.2 |
| | 15 | 178 | 35 | 49.0 | 0 | 46 | 16.7 | | 30 | 231 | 43 | 50.5 | 2 | 07 | 36.5 |
| | 16 | 179 | 46 | 48.2 | +0 | 43 | 24.5 | Oct. | 1 | 232 | 50 | 43.2 | -2 | 11 | 34.9 |

**VENUS, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| Oct. | 1 | 232 | 50 | 43.2 | -2 | 11 | 34.9 | Nov. | 16 | 279 | 31 | 11.3 | -3 | 45 | 13.8 |
| | 2 | 233 | 57 | 27.2 | 2 | 15 | 31.5 | | 17 | 280 | 21 | 31.5 | 3 | 43 | 48.7 |
| | 3 | 235 | 04 | 02.3 | 2 | 19 | 26.0 | | 18 | 281 | 11 | 05.2 | 3 | 42 | 10.0 |
| | 4 | 236 | 10 | 28.3 | 2 | 23 | 18.3 | | 19 | 281 | 59 | 50.7 | 3 | 40 | 17.2 |
| | 5 | 237 | 16 | 45.0 | 2 | 27 | 08.1 | | 20 | 282 | 47 | 45.9 | 3 | 38 | 09.9 |
| | 6 | 238 | 22 | 52.0 | 2 | 30 | 55.4 | | 21 | 283 | 34 | 48.9 | 3 | 35 | 47.8 |
| | 7 | 239 | 28 | 49.1 | -2 | 34 | 39.9 | | 22 | 284 | 20 | 57.4 | -3 | 33 | 10.3 |
| | 8 | 240 | 34 | 35.9 | 2 | 38 | 21.4 | | 23 | 285 | 06 | 09.4 | 3 | 30 | 17.1 |
| | 9 | 241 | 40 | 12.1 | 2 | 41 | 59.8 | | 24 | 285 | 50 | 22.6 | 3 | 27 | 07.7 |
| | 10 | 242 | 45 | 37.2 | 2 | 45 | 34.8 | | 25 | 286 | 33 | 34.4 | 3 | 23 | 41.7 |
| | 11 | 243 | 50 | 50.8 | 2 | 49 | 06.2 | | 26 | 287 | 15 | 42.6 | 3 | 19 | 58.7 |
| | 12 | 244 | 55 | 52.5 | 2 | 52 | 33.9 | | 27 | 287 | 56 | 44.5 | 3 | 15 | 58.0 |
| | 13 | 246 | 00 | 41.6 | -2 | 55 | 57.6 | | 28 | 288 | 36 | 37.5 | -3 | 11 | 39.4 |
| | 14 | 247 | 05 | 17.8 | 2 | 59 | 17.2 | | 29 | 289 | 15 | 18.8 | 3 | 07 | 02.2 |
| | 15 | 248 | 09 | 40.4 | 3 | 02 | 32.3 | | 30 | 289 | 52 | 45.5 | 3 | 02 | 06.0 |
| | 16 | 249 | 13 | 49.2 | 3 | 05 | 42.9 | Dec. | 1 | 290 | 28 | 54.7 | 2 | 56 | 50.2 |
| | 17 | 250 | 17 | 43.5 | 3 | 08 | 48.7 | | 2 | 291 | 03 | 43.3 | 2 | 51 | 14.4 |
| | 18 | 251 | 21 | 22.9 | 3 | 11 | 49.4 | | 3 | 291 | 37 | 07.9 | 2 | 45 | 18.1 |
| | 19 | 252 | 24 | 46.9 | -3 | 14 | 44.9 | | 4 | 292 | 09 | 05.2 | -2 | 39 | 00.6 |
| | 20 | 253 | 27 | 55.2 | 3 | 17 | 34.9 | | 5 | 292 | 39 | 31.4 | 2 | 32 | 21.4 |
| | 21 | 254 | 30 | 47.1 | 3 | 20 | 19.3 | | 6 | 293 | 08 | 22.7 | 2 | 25 | 20.1 |
| | 22 | 255 | 33 | 22.2 | 3 | 22 | 57.8 | | 7 | 293 | 35 | 35.2 | 2 | 17 | 56.0 |
| | 23 | 256 | 35 | 40.0 | 3 | 25 | 30.2 | | 8 | 294 | 01 | 04.8 | 2 | 10 | 08.7 |
| | 24 | 257 | 37 | 39.9 | 3 | 27 | 56.2 | | 9 | 294 | 24 | 47.4 | 2 | 01 | 57.7 |
| | 25 | 258 | 39 | 21.4 | -3 | 30 | 15.7 | | 10 | 294 | 46 | 38.8 | -1 | 53 | 22.4 |
| | 26 | 259 | 40 | 43.8 | 3 | 32 | 28.4 | | 11 | 295 | 06 | 35.1 | 1 | 44 | 22.6 |
| | 27 | 260 | 41 | 46.4 | 3 | 34 | 34.1 | | 12 | 295 | 24 | 32.1 | 1 | 34 | 57.8 |
| | 28 | 261 | 42 | 28.7 | 3 | 36 | 32.6 | | 13 | 295 | 40 | 25.8 | 1 | 25 | 07.6 |
| | 29 | 262 | 42 | 49.9 | 3 | 38 | 23.6 | | 14 | 295 | 54 | 12.3 | 1 | 14 | 52.0 |
| | 30 | 263 | 42 | 49.3 | 3 | 40 | 06.8 | | 15 | 296 | 05 | 47.8 | 1 | 04 | 10.6 |
| | 31 | 264 | 42 | 26.2 | -3 | 41 | 42.1 | | 16 | 296 | 15 | 08.7 | -0 | 53 | 03.5 |
| Nov. | 1 | 265 | 41 | 39.7 | 3 | 43 | 09.1 | | 17 | 296 | 22 | 11.5 | 0 | 41 | 30.8 |
| | 2 | 266 | 40 | 29.0 | 3 | 44 | 27.7 | | 18 | 296 | 26 | 53.2 | 0 | 29 | 32.5 |
| | 3 | 267 | 38 | 53.3 | 3 | 45 | 37.5 | | 19 | 296 | 29 | 11.0 | 0 | 17 | 09.1 |
| | 4 | 268 | 36 | 51.6 | 3 | 46 | 38.3 | | 20 | 296 | 29 | 02.4 | -0 | 04 | 21.1 |
| | 5 | 269 | 34 | 22.9 | 3 | 47 | 29.8 | | 21 | 296 | 26 | 25.6 | +0 | 08 | 50.8 |
| | 6 | 270 | 31 | 26.2 | -3 | 48 | 11.7 | | 22 | 296 | 21 | 19.3 | +0 | 22 | 25.8 |
| | 7 | 271 | 28 | 00.1 | 3 | 48 | 43.7 | | 23 | 296 | 13 | 42.7 | 0 | 36 | 22.6 |
| | 8 | 272 | 24 | 03.4 | 3 | 49 | 05.6 | | 24 | 296 | 03 | 36.0 | 0 | 50 | 39.9 |
| | 9 | 273 | 19 | 34.6 | 3 | 49 | 16.9 | | 25 | 295 | 51 | 00.0 | 1 | 05 | 16.1 |
| | 10 | 274 | 14 | 32.4 | 3 | 49 | 17.4 | | 26 | 295 | 35 | 56.5 | 1 | 20 | 09.3 |
| | 11 | 275 | 08 | 55.3 | 3 | 49 | 06.7 | | 27 | 295 | 18 | 28.1 | 1 | 35 | 17.3 |
| | 12 | 276 | 02 | 41.7 | -3 | 48 | 44.6 | | 28 | 294 | 58 | 38.7 | +1 | 50 | 37.5 |
| | 13 | 276 | 55 | 50.1 | 3 | 48 | 10.5 | | 29 | 294 | 36 | 33.0 | 2 | 06 | 07.4 |
| | 14 | 277 | 48 | 18.9 | 3 | 47 | 24.3 | | 30 | 294 | 12 | 16.9 | 2 | 21 | 43.9 |
| | 15 | 278 | 40 | 06.6 | 3 | 46 | 25.5 | | 31 | 293 | 45 | 57.5 | 2 | 37 | 23.8 |
| | 16 | 279 | 31 | 11.3 | -3 | 45 | 13.8 | | 32 | 293 | 17 | 42.7 | +2 | 53 | 03.6 |

**VENUS, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Jan | 0 | 17 | 13 | 04.99 | -22 | 17 | 49.7 | 1.556 315 | 5.65 | 5.36 | 10 | 34 | 12 |
| | 1 | 17 | 18 | 28.18 | 22 | 26 | 01.2 | 1.559 904 | 5.64 | 5.35 | 10 | 35 | 39 |
| | 2 | 17 | 23 | 52.03 | 22 | 33 | 32.5 | 1.563 456 | 5.62 | 5.33 | 10 | 37 | 07 |
| | 3 | 17 | 29 | 16.48 | 22 | 40 | 23.2 | 1.566 971 | 5.61 | 5.32 | 10 | 38 | 35 |
| | 4 | 17 | 34 | 41.50 | 22 | 46 | 32.9 | 1.570 448 | 5.60 | 5.31 | 10 | 40 | 04 |
| | 5 | 17 | 40 | 07.01 | 22 | 52 | 01.3 | 1.573 887 | 5.59 | 5.30 | 10 | 41 | 33 |
| | 6 | 17 | 45 | 32.99 | -22 | 56 | 48.1 | 1.577 289 | 5.58 | 5.29 | 10 | 43 | 03 |
| | 7 | 17 | 50 | 59.36 | 23 | 00 | 53.0 | 1.580 652 | 5.56 | 5.28 | 10 | 44 | 33 |
| | 8 | 17 | 56 | 26.07 | 23 | 04 | 15.9 | 1.583 976 | 5.55 | 5.27 | 10 | 46 | 03 |
| | 9 | 18 | 01 | 53.07 | 23 | 06 | 56.4 | 1.587 262 | 5.54 | 5.25 | 10 | 47 | 34 |
| | 10 | 18 | 07 | 20.29 | 23 | 08 | 54.5 | 1.590 508 | 5.53 | 5.24 | 10 | 49 | 05 |
| | 11 | 18 | 12 | 47.67 | 23 | 10 | 10.1 | 1.593 715 | 5.52 | 5.23 | 10 | 50 | 36 |
| | 12 | 18 | 18 | 15.14 | -23 | 10 | 42.9 | 1.596 883 | 5.51 | 5.22 | 10 | 52 | 07 |
| | 13 | 18 | 23 | 42.64 | 23 | 10 | 33.0 | 1.600 012 | 5.50 | 5.21 | 10 | 53 | 38 |
| | 14 | 18 | 29 | 10.10 | 23 | 09 | 40.4 | 1.603 102 | 5.49 | 5.20 | 10 | 55 | 09 |
| | 15 | 18 | 34 | 37.47 | 23 | 08 | 04.9 | 1.606 152 | 5.48 | 5.19 | 10 | 56 | 39 |
| | 16 | 18 | 40 | 04.66 | 23 | 05 | 46.7 | 1.609 164 | 5.47 | 5.18 | 10 | 58 | 10 |
| | 17 | 18 | 45 | 31.63 | 23 | 02 | 45.9 | 1.612 137 | 5.45 | 5.17 | 10 | 59 | 41 |
| | 18 | 18 | 50 | 58.32 | -22 | 59 | 02.5 | 1.615 072 | 5.45 | 5.16 | 11 | 01 | 11 |
| | 19 | 18 | 56 | 24.66 | 22 | 54 | 36.6 | 1.617 968 | 5.44 | 5.15 | 11 | 02 | 40 |
| | 20 | 19 | 01 | 50.61 | 22 | 49 | 28.5 | 1.620 827 | 5.43 | 5.15 | 11 | 04 | 10 |
| | 21 | 19 | 07 | 16.10 | 22 | 43 | 38.3 | 1.623 649 | 5.42 | 5.14 | 11 | 05 | 38 |
| | 22 | 19 | 12 | 41.08 | 22 | 37 | 06.3 | 1.626 433 | 5.41 | 5.13 | 11 | 07 | 07 |
| | 23 | 19 | 18 | 05.50 | 22 | 29 | 52.7 | 1.629 179 | 5.40 | 5.12 | 11 | 08 | 34 |
| | 24 | 19 | 23 | 29.31 | -22 | 21 | 58.0 | 1.631 889 | 5.39 | 5.11 | 11 | 10 | 01 |
| | 25 | 19 | 28 | 52.46 | 22 | 13 | 22.3 | 1.634 562 | 5.38 | 5.10 | 11 | 11 | 28 |
| | 26 | 19 | 34 | 14.91 | 22 | 04 | 06.0 | 1.637 198 | 5.37 | 5.09 | 11 | 12 | 53 |
| | 27 | 19 | 39 | 36.60 | 21 | 54 | 09.6 | 1.639 798 | 5.36 | 5.09 | 11 | 14 | 18 |
| | 28 | 19 | 44 | 57.49 | 21 | 43 | 33.5 | 1.642 361 | 5.35 | 5.08 | 11 | 15 | 42 |
| | 29 | 19 | 50 | 17.54 | 21 | 32 | 18.0 | 1.644 887 | 5.35 | 5.07 | 11 | 17 | 05 |
| | 30 | 19 | 55 | 36.72 | -21 | 20 | 23.6 | 1.647 377 | 5.34 | 5.06 | 11 | 18 | 28 |
| | 31 | 20 | 00 | 54.98 | 21 | 07 | 50.8 | 1.649 830 | 5.33 | 5.06 | 11 | 19 | 49 |
| Feb | 1 | 20 | 06 | 12.29 | 20 | 54 | 40.0 | 1.652 246 | 5.32 | 5.05 | 11 | 21 | 09 |
| | 2 | 20 | 11 | 28.63 | 20 | 40 | 51.9 | 1.654 626 | 5.31 | 5.04 | 11 | 22 | 29 |
| | 3 | 20 | 16 | 43.96 | 20 | 26 | 26.8 | 1.656 967 | 5.31 | 5.03 | 11 | 23 | 47 |
| | 4 | 20 | 21 | 58.27 | 20 | 11 | 25.4 | 1.659 271 | 5.30 | 5.03 | 11 | 25 | 04 |
| | 5 | 20 | 27 | 11.52 | -19 | 55 | 48.2 | 1.661 537 | 5.29 | 5.02 | 11 | 26 | 21 |
| | 6 | 20 | 32 | 23.69 | 19 | 39 | 35.8 | 1.663 764 | 5.29 | 5.01 | 11 | 27 | 36 |
| | 7 | 20 | 37 | 34.76 | 19 | 22 | 48.8 | 1.665 952 | 5.28 | 5.01 | 11 | 28 | 50 |
| | 8 | 20 | 42 | 44.71 | 19 | 05 | 28.0 | 1.668 101 | 5.27 | 5.00 | 11 | 30 | 03 |
| | 9 | 20 | 47 | 53.53 | 18 | 47 | 33.9 | 1.670 210 | 5.27 | 4.99 | 11 | 31 | 15 |
| | 10 | 20 | 53 | 01.18 | 18 | 29 | 07.2 | 1.672 280 | 5.26 | 4.99 | 11 | 32 | 25 |
| | 11 | 20 | 58 | 07.66 | -18 | 10 | 08.6 | 1.674 310 | 5.25 | 4.98 | 11 | 33 | 35 |
| | 12 | 21 | 03 | 12.96 | 17 | 50 | 38.8 | 1.676 299 | 5.25 | 4.98 | 11 | 34 | 43 |
| | 13 | 21 | 08 | 17.07 | 17 | 30 | 38.5 | 1.678 249 | 5.24 | 4.97 | 11 | 35 | 50 |
| | 14 | 21 | 13 | 19.98 | 17 | 10 | 08.3 | 1.680 159 | 5.23 | 4.96 | 11 | 36 | 56 |
| | 15 | 21 | 18 | 21.70 | -16 | 49 | 09.0 | 1.682 029 | 5.23 | 4.96 | 11 | 38 | 00 |

**VENUS, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Feb | 15 | 21 | 18 | 21.70 | -16 | 49 | 09.0 | 1.682 029 | 5.23 | 4.96 | 11 | 38 | 00 |
| | 16 | 21 | 23 | 22.22 | 16 | 27 | 41.3 | 1.683 859 | 5.22 | 4.95 | 11 | 39 | 04 |
| | 17 | 21 | 28 | 21.55 | 16 | 05 | 46.0 | 1.685 649 | 5.22 | 4.95 | 11 | 40 | 06 |
| | 18 | 21 | 33 | 19.70 | 15 | 43 | 23.7 | 1.687 399 | 5.21 | 4.94 | 11 | 41 | 07 |
| | 19 | 21 | 38 | 16.67 | 15 | 20 | 35.2 | 1.689 110 | 5.21 | 4.94 | 11 | 42 | 07 |
| | 20 | 21 | 43 | 12.47 | 14 | 57 | 21.3 | 1.690 781 | 5.20 | 4.93 | 11 | 43 | 06 |
| | 21 | 21 | 48 | 07.12 | -14 | 33 | 42.8 | 1.692 413 | 5.20 | 4.93 | 11 | 44 | 03 |
| | 22 | 21 | 53 | 00.64 | 14 | 09 | 40.2 | 1.694 006 | 5.19 | 4.92 | 11 | 44 | 60 |
| | 23 | 21 | 57 | 53.03 | 13 | 45 | 14.5 | 1.695 559 | 5.19 | 4.92 | 11 | 45 | 55 |
| | 24 | 22 | 02 | 44.32 | 13 | 20 | 26.4 | 1.697 073 | 5.18 | 4.91 | 11 | 46 | 49 |
| | 25 | 22 | 07 | 34.52 | 12 | 55 | 16.6 | 1.698 548 | 5.18 | 4.91 | 11 | 47 | 42 |
| | 26 | 22 | 12 | 23.66 | 12 | 29 | 45.9 | 1.699 984 | 5.17 | 4.91 | 11 | 48 | 34 |
| | 27 | 22 | 17 | 11.75 | -12 | 03 | 55.1 | 1.701 380 | 5.17 | 4.90 | 11 | 49 | 26 |
| | 28 | 22 | 21 | 58.84 | 11 | 37 | 44.8 | 1.702 738 | 5.16 | 4.90 | 11 | 50 | 16 |
| Mar | 1 | 22 | 26 | 44.95 | 11 | 11 | 15.8 | 1.704 056 | 5.16 | 4.89 | 11 | 51 | 05 |
| | 2 | 22 | 31 | 30.10 | 10 | 44 | 28.8 | 1.705 334 | 5.16 | 4.89 | 11 | 51 | 53 |
| | 3 | 22 | 36 | 14.33 | 10 | 17 | 24.6 | 1.706 571 | 5.15 | 4.89 | 11 | 52 | 40 |
| | 4 | 22 | 40 | 57.68 | 9 | 50 | 03.9 | 1.707 769 | 5.15 | 4.88 | 11 | 53 | 27 |
| | 5 | 22 | 45 | 40.18 | -9 | 22 | 27.4 | 1.708 925 | 5.15 | 4.88 | 11 | 54 | 12 |
| | 6 | 22 | 50 | 21.85 | 8 | 54 | 35.9 | 1.710 039 | 5.14 | 4.88 | 11 | 54 | 57 |
| | 7 | 22 | 55 | 02.73 | 8 | 26 | 30.1 | 1.711 112 | 5.14 | 4.87 | 11 | 55 | 41 |
| | 8 | 22 | 59 | 42.86 | 7 | 58 | 10.8 | 1.712 141 | 5.14 | 4.87 | 11 | 56 | 24 |
| | 9 | 23 | 04 | 22.25 | 7 | 29 | 38.8 | 1.713 128 | 5.13 | 4.87 | 11 | 57 | 07 |
| | 10 | 23 | 09 | 00.95 | 7 | 00 | 54.8 | 1.714 071 | 5.13 | 4.87 | 11 | 57 | 48 |
| | 11 | 23 | 13 | 38.99 | -6 | 31 | 59.5 | 1.714 970 | 5.13 | 4.86 | 11 | 58 | 30 |
| | 12 | 23 | 18 | 16.41 | 6 | 02 | 53.8 | 1.715 824 | 5.13 | 4.86 | 11 | 59 | 10 |
| | 13 | 23 | 22 | 53.23 | 5 | 33 | 38.3 | 1.716 634 | 5.12 | 4.86 | 11 | 59 | 50 |
| | 14 | 23 | 27 | 29.51 | 5 | 04 | 13.8 | 1.717 400 | 5.12 | 4.86 | 12 | 00 | 30 |
| | 15 | 23 | 32 | 05.27 | 4 | 34 | 41.1 | 1.718 120 | 5.12 | 4.85 | 12 | 01 | 09 |
| | 16 | 23 | 36 | 40.56 | 4 | 05 | 00.9 | 1.718 795 | 5.12 | 4.85 | 12 | 01 | 47 |
| | 17 | 23 | 41 | 15.41 | -3 | 35 | 13.9 | 1.719 425 | 5.11 | 4.85 | 12 | 02 | 25 |
| | 18 | 23 | 45 | 49.86 | 3 | 05 | 20.8 | 1.720 009 | 5.11 | 4.85 | 12 | 03 | 03 |
| | 19 | 23 | 50 | 23.96 | 2 | 35 | 22.5 | 1.720 547 | 5.11 | 4.85 | 12 | 03 | 40 |
| | 20 | 23 | 54 | 57.75 | 2 | 05 | 19.6 | 1.721 041 | 5.11 | 4.85 | 12 | 04 | 18 |
| | 21 | 23 | 59 | 31.26 | 1 | 35 | 12.9 | 1.721 488 | 5.11 | 4.84 | 12 | 04 | 54 |
| | 22 | 0 | 04 | 04.53 | -1 | 05 | 03.1 | 1.721 890 | 5.11 | 4.84 | 12 | 05 | 31 |
| | 23 | 0 | 08 | 37.62 | +0 | 34 | 50.9 | 1.722 246 | 5.11 | 4.84 | 12 | 06 | 07 |
| | 24 | 0 | 13 | 10.55 | 0 | 04 | 37.2 | 1.722 556 | 5.11 | 4.84 | 12 | 06 | 44 |
| | 25 | 0 | 17 | 43.37 | 0 | 25 | 37.5 | 1.722 821 | 5.10 | 4.84 | 12 | 07 | 20 |
| | 26 | 0 | 22 | 16.12 | 0 | 55 | 52.3 | 1.723 040 | 5.10 | 4.84 | 12 | 07 | 56 |
| | 27 | 0 | 26 | 48.85 | 1 | 26 | 06.6 | 1.723 213 | 5.10 | 4.84 | 12 | 08 | 32 |
| | 28 | 0 | 31 | 21.59 | 1 | 56 | 19.6 | 1.723 341 | 5.10 | 4.84 | 12 | 09 | 09 |
| | 29 | 0 | 35 | 54.40 | +2 | 26 | 30.7 | 1.723 422 | 5.10 | 4.84 | 12 | 09 | 45 |
| | 30 | 0 | 40 | 27.32 | 2 | 56 | 39.1 | 1.723 457 | 5.10 | 4.84 | 12 | 10 | 21 |
| | 31 | 0 | 45 | 00.39 | 3 | 26 | 44.1 | 1.723 446 | 5.10 | 4.84 | 12 | 10 | 58 |
| Apr | 1 | 0 | 49 | 33.67 | 3 | 56 | 45.1 | 1.723 388 | 5.10 | 4.84 | 12 | 11 | 35 |
| | 2 | 0 | 54 | 07.19 | +4 | 26 | 41.4 | 1.723 282 | 5.10 | 4.84 | 12 | 12 | 12 |

**VENUS, 2020**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Apr | 1 | 0 | 49 | 33.67 | +3 | 56 | 45.1 | 1.723 388 | 5.10 | 4.84 | 12 | 11 | 35 |
| | 2 | 0 | 54 | 07.19 | 4 | 26 | 41.4 | 1.723 282 | 5.10 | 4.84 | 12 | 12 | 12 |
| | 3 | 0 | 58 | 41.01 | 4 | 56 | 32.2 | 1.723 129 | 5.10 | 4.84 | 12 | 12 | 50 |
| | 4 | 1 | 03 | 15.14 | 5 | 26 | 16.7 | 1.722 927 | 5.10 | 4.84 | 12 | 13 | 27 |
| | 5 | 1 | 07 | 49.65 | 5 | 55 | 54.4 | 1.722 676 | 5.10 | 4.84 | 12 | 14 | 05 |
| | 6 | 1 | 12 | 24.56 | 6 | 25 | 24.4 | 1.722 375 | 5.11 | 4.84 | 12 | 14 | 44 |
| | 7 | 1 | 16 | 59.91 | +6 | 54 | 45.9 | 1.722 024 | 5.11 | 4.84 | 12 | 15 | 23 |
| | 8 | 1 | 21 | 35.74 | 7 | 23 | 58.4 | 1.721 622 | 5.11 | 4.84 | 12 | 16 | 03 |
| | 9 | 1 | 26 | 12.09 | 7 | 53 | 00.9 | 1.721 169 | 5.11 | 4.85 | 12 | 16 | 43 |
| | 10 | 1 | 30 | 48.99 | 8 | 21 | 52.8 | 1.720 664 | 5.11 | 4.85 | 12 | 17 | 23 |
| | 11 | 1 | 35 | 26.49 | 8 | 50 | 33.3 | 1.720 107 | 5.11 | 4.85 | 12 | 18 | 05 |
| | 12 | 1 | 40 | 04.61 | 9 | 19 | 01.7 | 1.719 498 | 5.11 | 4.85 | 12 | 18 | 47 |
| | 13 | 1 | 44 | 43.40 | +9 | 47 | 17.3 | 1.718 837 | 5.12 | 4.85 | 12 | 19 | 29 |
| | 14 | 1 | 49 | 22.89 | 10 | 15 | 19.2 | 1.718 122 | 5.12 | 4.85 | 12 | 20 | 13 |
| | 15 | 1 | 54 | 03.10 | 10 | 43 | 06.8 | 1.717 355 | 5.12 | 4.86 | 12 | 20 | 57 |
| | 16 | 1 | 58 | 44.08 | 11 | 10 | 39.3 | 1.716 534 | 5.12 | 4.86 | 12 | 21 | 42 |
| | 17 | 2 | 03 | 25.85 | 11 | 37 | 56.0 | 1.715 659 | 5.13 | 4.86 | 12 | 22 | 27 |
| | 18 | 2 | 08 | 08.44 | 12 | 04 | 56.0 | 1.714 732 | 5.13 | 4.86 | 12 | 23 | 14 |
| | 19 | 2 | 12 | 51.87 | +12 | 31 | 38.6 | 1.713 750 | 5.13 | 4.87 | 12 | 24 | 01 |
| | 20 | 2 | 17 | 36.18 | 12 | 58 | 03.2 | 1.712 715 | 5.13 | 4.87 | 12 | 24 | 49 |
| | 21 | 2 | 22 | 21.39 | 13 | 24 | 08.8 | 1.711 627 | 5.14 | 4.87 | 12 | 25 | 38 |
| | 22 | 2 | 27 | 07.53 | 13 | 49 | 54.8 | 1.710 484 | 5.14 | 4.88 | 12 | 26 | 29 |
| | 23 | 2 | 31 | 54.61 | 14 | 15 | 20.4 | 1.709 289 | 5.14 | 4.88 | 12 | 27 | 20 |
| | 24 | 2 | 36 | 42.66 | 14 | 40 | 24.9 | 1.708 040 | 5.15 | 4.88 | 12 | 28 | 12 |
| | 25 | 2 | 41 | 31.71 | +15 | 05 | 07.4 | 1.706 737 | 5.15 | 4.89 | 12 | 29 | 05 |
| | 26 | 2 | 46 | 21.78 | 15 | 29 | 27.4 | 1.705 381 | 5.16 | 4.89 | 12 | 29 | 59 |
| | 27 | 2 | 51 | 12.89 | 15 | 53 | 24.0 | 1.703 972 | 5.16 | 4.89 | 12 | 30 | 54 |
| | 28 | 2 | 56 | 05.05 | 16 | 16 | 56.6 | 1.702 509 | 5.17 | 4.90 | 12 | 31 | 50 |
| | 29 | 3 | 00 | 58.30 | 16 | 40 | 04.4 | 1.700 993 | 5.17 | 4.90 | 12 | 32 | 47 |
| | 30 | 3 | 05 | 52.64 | 17 | 02 | 46.8 | 1.699 424 | 5.17 | 4.91 | 12 | 33 | 46 |
| May | 1 | 3 | 10 | 48.09 | +17 | 25 | 02.9 | 1.697 800 | 5.18 | 4.91 | 12 | 34 | 45 |
| | 2 | 3 | 15 | 44.64 | 17 | 46 | 52.2 | 1.696 121 | 5.18 | 4.92 | 12 | 35 | 46 |
| | 3 | 3 | 20 | 42.32 | 18 | 08 | 13.8 | 1.694 388 | 5.19 | 4.92 | 12 | 36 | 48 |
| | 4 | 3 | 25 | 41.11 | 18 | 29 | 07.0 | 1.692 599 | 5.20 | 4.93 | 12 | 37 | 51 |
| | 5 | 3 | 30 | 41.03 | 18 | 49 | 31.1 | 1.690 755 | 5.20 | 4.93 | 12 | 38 | 55 |
| | 6 | 3 | 35 | 42.08 | 19 | 09 | 25.4 | 1.688 854 | 5.21 | 4.94 | 12 | 39 | 60 |
| | 7 | 3 | 40 | 44.24 | +19 | 28 | 49.3 | 1.686 896 | 5.21 | 4.94 | 12 | 41 | 06 |
| | 8 | 3 | 45 | 47.52 | 19 | 47 | 41.9 | 1.684 881 | 5.22 | 4.95 | 12 | 42 | 13 |
| | 9 | 3 | 50 | 51.91 | 20 | 06 | 02.6 | 1.682 810 | 5.23 | 4.96 | 12 | 43 | 22 |
| | 10 | 3 | 55 | 57.39 | 20 | 23 | 50.7 | 1.680 680 | 5.23 | 4.96 | 12 | 44 | 31 |
| | 11 | 4 | 01 | 03.96 | 20 | 41 | 05.7 | 1.678 493 | 5.24 | 4.97 | 12 | 45 | 42 |
| | 12 | 4 | 06 | 11.60 | 20 | 57 | 46.7 | 1.676 248 | 5.25 | 4.98 | 12 | 46 | 54 |
| | 13 | 4 | 11 | 20.28 | +21 | 13 | 53.3 | 1.673 945 | 5.25 | 4.98 | 12 | 48 | 06 |
| | 14 | 4 | 16 | 29.99 | 21 | 29 | 24.7 | 1.671 583 | 5.26 | 4.99 | 12 | 49 | 20 |
| | 15 | 4 | 21 | 40.69 | 21 | 44 | 20.3 | 1.669 164 | 5.27 | 5.00 | 12 | 50 | 35 |
| | 16 | 4 | 26 | 52.37 | 21 | 58 | 39.7 | 1.666 686 | 5.28 | 5.00 | 12 | 51 | 51 |
| | 17 | 4 | 32 | 04.98 | +22 | 12 | 22.1 | 1.664 150 | 5.28 | 5.01 | 12 | 53 | 07 |

**VENUS, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| May | 17 | 4 | 32 | 04.98 | +22 | 12 | 22.1 | 1.664 150 | 5.28 | 5.01 | 12 | 53 | 07 |
| | 18 | 4 | 37 | 18.49 | 22 | 25 | 27.1 | 1.661 556 | 5.29 | 5.02 | 12 | 54 | 25 |
| | 19 | 4 | 42 | 32.87 | 22 | 37 | 54.0 | 1.658 904 | 5.30 | 5.03 | 12 | 55 | 43 |
| | 20 | 4 | 47 | 48.08 | 22 | 49 | 42.4 | 1.656 195 | 5.31 | 5.04 | 12 | 57 | 02 |
| | 21 | 4 | 53 | 04.08 | 23 | 00 | 51.8 | 1.653 428 | 5.32 | 5.04 | 12 | 58 | 22 |
| | 22 | 4 | 58 | 20.83 | 23 | 11 | 21.7 | 1.650 603 | 5.33 | 5.05 | 12 | 59 | 43 |
| | 23 | 5 | 03 | 38.28 | +23 | 21 | 11.7 | 1.647 722 | 5.34 | 5.06 | 13 | 01 | 04 |
| | 24 | 5 | 08 | 56.39 | 23 | 30 | 21.3 | 1.644 784 | 5.35 | 5.07 | 13 | 02 | 26 |
| | 25 | 5 | 14 | 15.12 | 23 | 38 | 50.2 | 1.641 791 | 5.36 | 5.08 | 13 | 03 | 49 |
| | 26 | 5 | 19 | 34.43 | 23 | 46 | 38.0 | 1.638 741 | 5.37 | 5.09 | 13 | 05 | 12 |
| | 27 | 5 | 24 | 54.26 | 23 | 53 | 44.4 | 1.635 636 | 5.38 | 5.10 | 13 | 06 | 35 |
| | 28 | 5 | 30 | 14.56 | 24 | 00 | 09.2 | 1.632 476 | 5.39 | 5.11 | 13 | 07 | 59 |
| | 29 | 5 | 35 | 35.27 | +24 | 05 | 52.0 | 1.629 260 | 5.40 | 5.12 | 13 | 09 | 24 |
| | 30 | 5 | 40 | 56.36 | 24 | 10 | 52.6 | 1.625 989 | 5.41 | 5.13 | 13 | 10 | 49 |
| | 31 | 5 | 46 | 17.74 | 24 | 15 | 10.8 | 1.622 663 | 5.42 | 5.14 | 13 | 12 | 14 |
| Jun | 1 | 5 | 51 | 39.38 | 24 | 18 | 46.4 | 1.619 281 | 5.43 | 5.15 | 13 | 13 | 39 |
| | 2 | 5 | 57 | 01.20 | 24 | 21 | 39.1 | 1.615 844 | 5.44 | 5.16 | 13 | 15 | 04 |
| | 3 | 6 | 02 | 23.16 | 24 | 23 | 48.9 | 1.612 350 | 5.45 | 5.17 | 13 | 16 | 30 |
| | 4 | 6 | 07 | 45.19 | +24 | 25 | 15.7 | 1.608 801 | 5.47 | 5.18 | 13 | 17 | 56 |
| | 5 | 6 | 13 | 07.23 | 24 | 25 | 59.3 | 1.605 196 | 5.48 | 5.20 | 13 | 19 | 21 |
| | 6 | 6 | 18 | 29.22 | 24 | 25 | 59.8 | 1.601 535 | 5.49 | 5.21 | 13 | 20 | 47 |
| | 7 | 6 | 23 | 51.10 | 24 | 25 | 17.1 | 1.597 818 | 5.50 | 5.22 | 13 | 22 | 12 |
| | 8 | 6 | 29 | 12.81 | 24 | 23 | 51.2 | 1.594 045 | 5.52 | 5.23 | 13 | 23 | 37 |
| | 9 | 6 | 34 | 34.28 | 24 | 21 | 42.3 | 1.590 216 | 5.53 | 5.24 | 13 | 25 | 02 |
| | 10 | 6 | 39 | 55.45 | +24 | 18 | 50.4 | 1.586 331 | 5.54 | 5.26 | 13 | 26 | 26 |
| | 11 | 6 | 45 | 16.25 | 24 | 15 | 15.6 | 1.582 390 | 5.56 | 5.27 | 13 | 27 | 50 |
| | 12 | 6 | 50 | 36.63 | 24 | 10 | 58.2 | 1.578 393 | 5.57 | 5.28 | 13 | 29 | 14 |
| | 13 | 6 | 55 | 56.52 | 24 | 05 | 58.2 | 1.574 341 | 5.59 | 5.30 | 13 | 30 | 37 |
| | 14 | 7 | 01 | 15.85 | 24 | 00 | 15.9 | 1.570 234 | 5.60 | 5.31 | 13 | 31 | 60 |
| | 15 | 7 | 06 | 34.58 | 23 | 53 | 51.6 | 1.566 071 | 5.62 | 5.33 | 13 | 33 | 22 |
| | 16 | 7 | 11 | 52.64 | +23 | 46 | 45.5 | 1.561 854 | 5.63 | 5.34 | 13 | 34 | 43 |
| | 17 | 7 | 17 | 09.97 | 23 | 38 | 57.9 | 1.557 583 | 5.65 | 5.35 | 13 | 36 | 03 |
| | 18 | 7 | 22 | 26.52 | 23 | 30 | 29.1 | 1.553 258 | 5.66 | 5.37 | 13 | 37 | 23 |
| | 19 | 7 | 27 | 42.24 | 23 | 21 | 19.6 | 1.548 880 | 5.68 | 5.38 | 13 | 38 | 41 |
| | 20 | 7 | 32 | 57.08 | 23 | 11 | 29.6 | 1.544 449 | 5.69 | 5.40 | 13 | 39 | 59 |
| | 21 | 7 | 38 | 10.99 | 23 | 00 | 59.7 | 1.539 966 | 5.71 | 5.42 | 13 | 41 | 16 |
| | 22 | 7 | 43 | 23.95 | +22 | 49 | 50.2 | 1.535 432 | 5.73 | 5.43 | 13 | 42 | 32 |
| | 23 | 7 | 48 | 35.89 | 22 | 38 | 01.7 | 1.530 847 | 5.74 | 5.45 | 13 | 43 | 47 |
| | 24 | 7 | 53 | 46.79 | 22 | 25 | 34.6 | 1.526 212 | 5.76 | 5.46 | 13 | 45 | 01 |
| | 25 | 7 | 58 | 56.62 | 22 | 12 | 29.4 | 1.521 528 | 5.78 | 5.48 | 13 | 46 | 13 |
| | 26 | 8 | 04 | 05.32 | 21 | 58 | 46.6 | 1.516 795 | 5.80 | 5.50 | 13 | 47 | 25 |
| | 27 | 8 | 09 | 12.88 | 21 | 44 | 26.9 | 1.512 013 | 5.82 | 5.52 | 13 | 48 | 35 |
| | 28 | 8 | 14 | 19.27 | +21 | 29 | 30.8 | 1.507 183 | 5.83 | 5.53 | 13 | 49 | 45 |
| | 29 | 8 | 19 | 24.46 | 21 | 13 | 58.7 | 1.502 306 | 5.85 | 5.55 | 13 | 50 | 53 |
| | 30 | 8 | 24 | 28.43 | 20 | 57 | 51.3 | 1.497 380 | 5.87 | 5.57 | 13 | 51 | 59 |
| Jul | 1 | 8 | 29 | 31.16 | 20 | 41 | 09.2 | 1.492 408 | 5.89 | 5.59 | 13 | 53 | 05 |
| | 2 | 8 | 34 | 32.64 | +20 | 23 | 53.0 | 1.487 388 | 5.91 | 5.61 | 13 | 54 | 09 |

**VENUS, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Jul | 1 | 8 | 29 | 31.16 | +20 | 41 | 09.2 | 1.492 408 | 5.89 | 5.59 | 13 | 53 | 05 |
| | 2 | 8 | 34 | 32.64 | 20 | 23 | 53.0 | 1.487 388 | 5.91 | 5.61 | 13 | 54 | 09 |
| | 3 | 8 | 39 | 32.85 | 20 | 06 | 03.2 | 1.482 321 | 5.93 | 5.63 | 13 | 55 | 12 |
| | 4 | 8 | 44 | 31.77 | 19 | 47 | 40.6 | 1.477 206 | 5.95 | 5.65 | 13 | 56 | 14 |
| | 5 | 8 | 49 | 29.40 | 19 | 28 | 45.8 | 1.472 046 | 5.97 | 5.67 | 13 | 57 | 14 |
| | 6 | 8 | 54 | 25.72 | 19 | 09 | 19.4 | 1.466 838 | 6.00 | 5.69 | 13 | 58 | 13 |
| | 7 | 8 | 59 | 20.73 | +18 | 49 | 22.1 | 1.461 585 | 6.02 | 5.71 | 13 | 59 | 11 |
| | 8 | 9 | 04 | 14.43 | 18 | 28 | 54.7 | 1.456 285 | 6.04 | 5.73 | 14 | 00 | 07 |
| | 9 | 9 | 09 | 06.80 | 18 | 07 | 57.7 | 1.450 940 | 6.06 | 5.75 | 14 | 01 | 02 |
| | 10 | 9 | 13 | 57.84 | 17 | 46 | 31.9 | 1.445 548 | 6.08 | 5.77 | 14 | 01 | 56 |
| | 11 | 9 | 18 | 47.56 | 17 | 24 | 38.1 | 1.440 112 | 6.11 | 5.79 | 14 | 02 | 48 |
| | 12 | 9 | 23 | 35.95 | 17 | 02 | 16.8 | 1.434 631 | 6.13 | 5.81 | 14 | 03 | 39 |
| | 13 | 9 | 28 | 23.02 | +16 | 39 | 28.9 | 1.429 105 | 6.15 | 5.84 | 14 | 04 | 29 |
| | 14 | 9 | 33 | 08.77 | 16 | 16 | 15.1 | 1.423 535 | 6.18 | 5.86 | 14 | 05 | 18 |
| | 15 | 9 | 37 | 53.21 | 15 | 52 | 36.0 | 1.417 921 | 6.20 | 5.88 | 14 | 06 | 05 |
| | 16 | 9 | 42 | 36.35 | 15 | 28 | 32.4 | 1.412 265 | 6.23 | 5.91 | 14 | 06 | 51 |
| | 17 | 9 | 47 | 18.20 | 15 | 04 | 05.1 | 1.406 565 | 6.25 | 5.93 | 14 | 07 | 35 |
| | 18 | 9 | 51 | 58.78 | 14 | 39 | 14.7 | 1.400 825 | 6.28 | 5.95 | 14 | 08 | 19 |
| | 19 | 9 | 56 | 38.11 | +14 | 14 | 02.0 | 1.395 043 | 6.30 | 5.98 | 14 | 09 | 01 |
| | 20 | 10 | 01 | 16.20 | 13 | 48 | 27.7 | 1.389 220 | 6.33 | 6.00 | 14 | 09 | 41 |
| | 21 | 10 | 05 | 53.07 | 13 | 22 | 32.6 | 1.383 359 | 6.36 | 6.03 | 14 | 10 | 21 |
| | 22 | 10 | 10 | 28.75 | 12 | 56 | 17.3 | 1.377 459 | 6.38 | 6.05 | 14 | 10 | 60 |
| | 23 | 10 | 15 | 03.25 | 12 | 29 | 42.7 | 1.371 521 | 6.41 | 6.08 | 14 | 11 | 37 |
| | 24 | 10 | 19 | 36.60 | 12 | 02 | 49.5 | 1.365 545 | 6.44 | 6.11 | 14 | 12 | 13 |
| | 25 | 10 | 24 | 08.83 | +11 | 35 | 38.3 | 1.359 534 | 6.47 | 6.13 | 14 | 12 | 48 |
| | 26 | 10 | 28 | 39.97 | 11 | 08 | 09.8 | 1.353 487 | 6.50 | 6.16 | 14 | 13 | 22 |
| | 27 | 10 | 33 | 10.05 | 10 | 40 | 24.8 | 1.347 405 | 6.53 | 6.19 | 14 | 13 | 55 |
| | 28 | 10 | 37 | 39.09 | 10 | 12 | 24.0 | 1.341 288 | 6.56 | 6.22 | 14 | 14 | 27 |
| | 29 | 10 | 42 | 07.14 | 9 | 44 | 07.9 | 1.335 136 | 6.59 | 6.25 | 14 | 14 | 58 |
| | 30 | 10 | 46 | 34.22 | 9 | 15 | 37.4 | 1.328 950 | 6.62 | 6.28 | 14 | 15 | 28 |
| | 31 | 10 | 51 | 00.38 | +8 | 46 | 53.0 | 1.322 731 | 6.65 | 6.31 | 14 | 15 | 57 |
| Aug | 1 | 10 | 55 | 25.65 | 8 | 17 | 55.5 | 1.316 478 | 6.68 | 6.34 | 14 | 16 | 25 |
| | 2 | 10 | 59 | 50.05 | 7 | 48 | 45.6 | 1.310 192 | 6.71 | 6.37 | 14 | 16 | 52 |
| | 3 | 11 | 04 | 13.63 | 7 | 19 | 23.9 | 1.303 874 | 6.74 | 6.40 | 14 | 17 | 19 |
| | 4 | 11 | 08 | 36.42 | 6 | 49 | 51.1 | 1.297 522 | 6.78 | 6.43 | 14 | 17 | 45 |
| | 5 | 11 | 12 | 58.46 | 6 | 20 | 08.0 | 1.291 138 | 6.81 | 6.46 | 14 | 18 | 10 |
| | 6 | 11 | 17 | 19.77 | +5 | 50 | 15.1 | 1.284 723 | 6.85 | 6.49 | 14 | 18 | 34 |
| | 7 | 11 | 21 | 40.39 | 5 | 20 | 13.2 | 1.278 275 | 6.88 | 6.52 | 14 | 18 | 58 |
| | 8 | 11 | 26 | 00.35 | 4 | 50 | 03.1 | 1.271 795 | 6.91 | 6.56 | 14 | 19 | 21 |
| | 9 | 11 | 30 | 19.70 | 4 | 19 | 45.2 | 1.265 285 | 6.95 | 6.59 | 14 | 19 | 43 |
| | 10 | 11 | 34 | 38.46 | 3 | 49 | 20.5 | 1.258 743 | 6.99 | 6.63 | 14 | 20 | 05 |
| | 11 | 11 | 38 | 56.66 | 3 | 18 | 49.5 | 1.252 170 | 7.02 | 6.66 | 14 | 20 | 26 |
| | 12 | 11 | 43 | 14.35 | +2 | 48 | 12.9 | 1.245 567 | 7.06 | 6.70 | 14 | 20 | 47 |
| | 13 | 11 | 47 | 31.55 | 2 | 17 | 31.4 | 1.238 934 | 7.10 | 6.73 | 14 | 21 | 08 |
| | 14 | 11 | 51 | 48.31 | 1 | 46 | 45.7 | 1.232 271 | 7.14 | 6.77 | 14 | 21 | 28 |
| | 15 | 11 | 56 | 04.66 | 1 | 15 | 56.5 | 1.225 580 | 7.18 | 6.80 | 14 | 21 | 47 |
| | 16 | 12 | 00 | 20.64 | +0 | 45 | 04.5 | 1.218 860 | 7.22 | 6.84 | 14 | 22 | 06 |

**VENUS, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Aug | 16 | 12 | 00 | 20.64 | +0 | 45 | 04.5 | 1.218 860 | 7.22 | 6.84 | 14 | 22 | 06 |
| | 17 | 12 | 04 | 36.27 | 0 | 14 | 10.3 | 1.212 113 | 7.26 | 6.88 | 14 | 22 | 25 |
| | 18 | 12 | 08 | 51.60 | 0 | 16 | 45.4 | 1.205 339 | 7.30 | 6.92 | 14 | 22 | 44 |
| | 19 | 12 | 13 | 06.67 | +0 | 47 | 41.9 | 1.198 539 | 7.34 | 6.96 | 14 | 23 | 02 |
| | 20 | 12 | 17 | 21.49 | -1 | 18 | 38.5 | 1.191 713 | 7.38 | 7.00 | 14 | 23 | 20 |
| | 21 | 12 | 21 | 36.12 | 1 | 49 | 34.5 | 1.184 864 | 7.42 | 7.04 | 14 | 23 | 38 |
| | 22 | 12 | 25 | 50.59 | -2 | 20 | 29.3 | 1.177 990 | 7.47 | 7.08 | 14 | 23 | 56 |
| | 23 | 12 | 30 | 04.94 | 2 | 51 | 22.3 | 1.171 093 | 7.51 | 7.12 | 14 | 24 | 14 |
| | 24 | 12 | 34 | 19.21 | 3 | 22 | 12.7 | 1.164 174 | 7.55 | 7.16 | 14 | 24 | 32 |
| | 25 | 12 | 38 | 33.44 | 3 | 53 | 00.1 | 1.157 232 | 7.60 | 7.21 | 14 | 24 | 49 |
| | 26 | 12 | 42 | 47.66 | 4 | 23 | 43.6 | 1.150 269 | 7.65 | 7.25 | 14 | 25 | 07 |
| | 27 | 12 | 47 | 01.93 | 4 | 54 | 22.8 | 1.143 285 | 7.69 | 7.29 | 14 | 25 | 25 |
| | 28 | 12 | 51 | 16.27 | -5 | 24 | 57.0 | 1.136 279 | 7.74 | 7.34 | 14 | 25 | 43 |
| | 29 | 12 | 55 | 30.72 | 5 | 55 | 25.6 | 1.129 254 | 7.79 | 7.39 | 14 | 26 | 01 |
| | 30 | 12 | 59 | 45.33 | 6 | 25 | 47.8 | 1.122 208 | 7.84 | 7.43 | 14 | 26 | 19 |
| | 31 | 13 | 04 | 00.12 | 6 | 56 | 03.2 | 1.115 141 | 7.89 | 7.48 | 14 | 26 | 37 |
| Sep | 1 | 13 | 08 | 15.13 | 7 | 26 | 10.9 | 1.108 055 | 7.94 | 7.53 | 14 | 26 | 56 |
| | 2 | 13 | 12 | 30.39 | 7 | 56 | 10.4 | 1.100 950 | 7.99 | 7.58 | 14 | 27 | 15 |
| | 3 | 13 | 16 | 45.94 | -8 | 26 | 01.1 | 1.093 825 | 8.04 | 7.62 | 14 | 27 | 34 |
| | 4 | 13 | 21 | 01.80 | 8 | 55 | 42.2 | 1.086 680 | 8.09 | 7.67 | 14 | 27 | 53 |
| | 5 | 13 | 25 | 18.00 | 9 | 25 | 13.1 | 1.079 516 | 8.15 | 7.73 | 14 | 28 | 13 |
| | 6 | 13 | 29 | 34.58 | 9 | 54 | 33.2 | 1.072 333 | 8.20 | 7.78 | 14 | 28 | 34 |
| | 7 | 13 | 33 | 51.55 | 10 | 23 | 41.7 | 1.065 131 | 8.26 | 7.83 | 14 | 28 | 54 |
| | 8 | 13 | 38 | 08.95 | 10 | 52 | 38.0 | 1.057 910 | 8.31 | 7.88 | 14 | 29 | 15 |
| | 9 | 13 | 42 | 26.80 | -11 | 21 | 21.4 | 1.050 671 | 8.37 | 7.94 | 14 | 29 | 37 |
| | 10 | 13 | 46 | 45.12 | 11 | 49 | 51.2 | 1.043 412 | 8.43 | 7.99 | 14 | 29 | 59 |
| | 11 | 13 | 51 | 03.94 | 12 | 18 | 06.8 | 1.036 136 | 8.49 | 8.05 | 14 | 30 | 22 |
| | 12 | 13 | 55 | 23.27 | 12 | 46 | 07.4 | 1.028 841 | 8.55 | 8.11 | 14 | 30 | 45 |
| | 13 | 13 | 59 | 43.14 | 13 | 13 | 52.5 | 1.021 530 | 8.61 | 8.16 | 14 | 31 | 08 |
| | 14 | 14 | 04 | 03.55 | 13 | 41 | 21.2 | 1.014 201 | 8.67 | 8.22 | 14 | 31 | 33 |
| | 15 | 14 | 08 | 24.52 | -14 | 08 | 32.9 | 1.006 855 | 8.73 | 8.28 | 14 | 31 | 57 |
| | 16 | 14 | 12 | 46.06 | 14 | 35 | 26.9 | 0.999 494 | 8.80 | 8.34 | 14 | 32 | 23 |
| | 17 | 14 | 17 | 08.19 | 15 | 02 | 02.6 | 0.992 118 | 8.86 | 8.41 | 14 | 32 | 49 |
| | 18 | 14 | 21 | 30.92 | 15 | 28 | 19.2 | 0.984 728 | 8.93 | 8.47 | 14 | 33 | 15 |
| | 19 | 14 | 25 | 54.25 | 15 | 54 | 16.1 | 0.977 324 | 9.00 | 8.53 | 14 | 33 | 42 |
| | 20 | 14 | 30 | 18.20 | 16 | 19 | 52.6 | 0.969 906 | 9.07 | 8.60 | 14 | 34 | 10 |
| | 21 | 14 | 34 | 42.79 | -16 | 45 | 08.0 | 0.962 476 | 9.14 | 8.67 | 14 | 34 | 39 |
| | 22 | 14 | 39 | 08.02 | 17 | 10 | 01.9 | 0.955 034 | 9.21 | 8.73 | 14 | 35 | 08 |
| | 23 | 14 | 43 | 33.89 | 17 | 34 | 33.4 | 0.947 580 | 9.28 | 8.80 | 14 | 35 | 37 |
| | 24 | 14 | 48 | 00.43 | 17 | 58 | 42.1 | 0.940 116 | 9.35 | 8.87 | 14 | 36 | 08 |
| | 25 | 14 | 52 | 27.62 | 18 | 22 | 27.2 | 0.932 640 | 9.43 | 8.94 | 14 | 36 | 39 |
| | 26 | 14 | 56 | 55.47 | 18 | 45 | 48.2 | 0.925 154 | 9.51 | 9.01 | 14 | 37 | 10 |
| | 27 | 15 | 01 | 23.99 | -19 | 08 | 44.5 | 0.917 658 | 9.58 | 9.09 | 14 | 37 | 43 |
| | 28 | 15 | 05 | 53.15 | 19 | 31 | 15.4 | 0.910 152 | 9.66 | 9.16 | 14 | 38 | 16 |
| | 29 | 15 | 10 | 22.96 | 19 | 53 | 20.4 | 0.902 637 | 9.74 | 9.24 | 14 | 38 | 50 |
| | 30 | 15 | 14 | 53.41 | 20 | 14 | 58.9 | 0.895 112 | 9.82 | 9.32 | 14 | 39 | 24 |
| Oct | 1 | 15 | 19 | 24.48 | -20 | 36 | 10.3 | 0.887 578 | 9.91 | 9.40 | 14 | 39 | 59 |

**VENUS, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Oct | 1 | 15 | 19 | 24.48 | -20 | 36 | 10.3 | 0.887 578 | 9.91 | 9.40 | 14 | 39 | 59 |
| | 2 | 15 | 23 | 56.16 | 20 | 56 | 53.9 | 0.880 035 | 9.99 | 9.48 | 14 | 40 | 34 |
| | 3 | 15 | 28 | 28.42 | 21 | 17 | 09.3 | 0.872 483 | 10.08 | 9.56 | 14 | 41 | 10 |
| | 4 | 15 | 33 | 01.24 | 21 | 36 | 55.8 | 0.864 923 | 10.17 | 9.64 | 14 | 41 | 47 |
| | 5 | 15 | 37 | 34.61 | 21 | 56 | 12.8 | 0.857 353 | 10.26 | 9.73 | 14 | 42 | 24 |
| | 6 | 15 | 42 | 08.48 | 22 | 14 | 59.9 | 0.849 775 | 10.35 | 9.81 | 14 | 43 | 02 |
| | 7 | 15 | 46 | 42.83 | -22 | 33 | 16.5 | 0.842 188 | 10.44 | 9.90 | 14 | 43 | 40 |
| | 8 | 15 | 51 | 17.62 | 22 | 51 | 02.0 | 0.834 593 | 10.54 | 9.99 | 14 | 44 | 18 |
| | 9 | 15 | 55 | 52.81 | 23 | 08 | 15.9 | 0.826 989 | 10.63 | 10.08 | 14 | 44 | 57 |
| | 10 | 16 | 00 | 28.34 | 23 | 24 | 57.8 | 0.819 377 | 10.73 | 10.18 | 14 | 45 | 36 |
| | 11 | 16 | 05 | 04.17 | 23 | 41 | 07.1 | 0.811 757 | 10.83 | 10.27 | 14 | 46 | 16 |
| | 12 | 16 | 09 | 40.24 | 23 | 56 | 43.4 | 0.804 131 | 10.94 | 10.37 | 14 | 46 | 55 |
| | 13 | 16 | 14 | 16.48 | -24 | 11 | 46.2 | 0.796 497 | 11.04 | 10.47 | 14 | 47 | 35 |
| | 14 | 16 | 18 | 52.83 | 24 | 26 | 15.1 | 0.788 857 | 11.15 | 10.57 | 14 | 48 | 15 |
| | 15 | 16 | 23 | 29.22 | 24 | 40 | 09.7 | 0.781 212 | 11.26 | 10.68 | 14 | 48 | 55 |
| | 16 | 16 | 28 | 05.60 | 24 | 53 | 29.5 | 0.773 563 | 11.37 | 10.78 | 14 | 49 | 35 |
| | 17 | 16 | 32 | 41.88 | 25 | 06 | 14.4 | 0.765 909 | 11.48 | 10.89 | 14 | 50 | 14 |
| | 18 | 16 | 37 | 18.01 | 25 | 18 | 23.8 | 0.758 252 | 11.60 | 11.00 | 14 | 50 | 54 |
| | 19 | 16 | 41 | 53.90 | -25 | 29 | 57.7 | 0.750 593 | 11.72 | 11.11 | 14 | 51 | 33 |
| | 20 | 16 | 46 | 29.49 | 25 | 40 | 55.6 | 0.742 933 | 11.84 | 11.23 | 14 | 52 | 12 |
| | 21 | 16 | 51 | 04.69 | 25 | 51 | 17.4 | 0.735 271 | 11.96 | 11.34 | 14 | 52 | 50 |
| | 22 | 16 | 55 | 39.43 | 26 | 01 | 03.0 | 0.727 610 | 12.09 | 11.46 | 14 | 53 | 28 |
| | 23 | 17 | 00 | 13.63 | 26 | 10 | 12.1 | 0.719 949 | 12.21 | 11.58 | 14 | 54 | 05 |
| | 24 | 17 | 04 | 47.19 | 26 | 18 | 44.7 | 0.712 289 | 12.35 | 11.71 | 14 | 54 | 42 |
| | 25 | 17 | 09 | 20.03 | -26 | 26 | 40.6 | 0.704 631 | 12.48 | 11.84 | 14 | 55 | 18 |
| | 26 | 17 | 13 | 52.06 | 26 | 33 | 59.9 | 0.696 975 | 12.62 | 11.97 | 14 | 55 | 53 |
| | 27 | 17 | 18 | 23.17 | 26 | 40 | 42.4 | 0.689 323 | 12.76 | 12.10 | 14 | 56 | 27 |
| | 28 | 17 | 22 | 53.28 | 26 | 46 | 48.2 | 0.681 674 | 12.90 | 12.23 | 14 | 56 | 60 |
| | 29 | 17 | 27 | 22.27 | 26 | 52 | 17.3 | 0.674 029 | 13.05 | 12.37 | 14 | 57 | 31 |
| | 30 | 17 | 31 | 50.05 | 26 | 57 | 09.7 | 0.666 389 | 13.20 | 12.52 | 14 | 58 | 02 |
| | 31 | 17 | 36 | 16.50 | -27 | 01 | 25.6 | 0.658 755 | 13.35 | 12.66 | 14 | 58 | 31 |
| Nov | 1 | 17 | 40 | 41.53 | 27 | 05 | 05.2 | 0.651 127 | 13.51 | 12.81 | 14 | 58 | 58 |
| | 2 | 17 | 45 | 05.01 | 27 | 08 | 08.4 | 0.643 505 | 13.67 | 12.96 | 14 | 59 | 24 |
| | 3 | 17 | 49 | 26.83 | 27 | 10 | 35.6 | 0.635 890 | 13.83 | 13.12 | 14 | 59 | 48 |
| | 4 | 17 | 53 | 46.87 | 27 | 12 | 27.0 | 0.628 282 | 14.00 | 13.27 | 15 | 00 | 11 |
| | 5 | 17 | 58 | 05.01 | 27 | 13 | 42.8 | 0.620 682 | 14.17 | 13.44 | 15 | 00 | 31 |
| | 6 | 18 | 02 | 21.12 | -27 | 14 | 23.3 | 0.613 091 | 14.34 | 13.60 | 15 | 00 | 49 |
| | 7 | 18 | 06 | 35.05 | 27 | 14 | 29.0 | 0.605 510 | 14.52 | 13.77 | 15 | 01 | 05 |
| | 8 | 18 | 10 | 46.67 | 27 | 14 | 00.1 | 0.597 938 | 14.71 | 13.95 | 15 | 01 | 19 |
| | 9 | 18 | 14 | 55.83 | 27 | 12 | 57.2 | 0.590 377 | 14.90 | 14.13 | 15 | 01 | 30 |
| | 10 | 18 | 19 | 02.36 | 27 | 11 | 20.5 | 0.582 829 | 15.09 | 14.31 | 15 | 01 | 38 |
| | 11 | 18 | 23 | 06.14 | 27 | 09 | 10.8 | 0.575 295 | 15.29 | 14.50 | 15 | 01 | 43 |
| | 12 | 18 | 27 | 06.98 | -27 | 06 | 28.3 | 0.567 776 | 15.49 | 14.69 | 15 | 01 | 46 |
| | 13 | 18 | 31 | 04.76 | 27 | 03 | 13.8 | 0.560 273 | 15.70 | 14.89 | 15 | 01 | 45 |
| | 14 | 18 | 34 | 59.31 | 26 | 59 | 27.7 | 0.552 789 | 15.91 | 15.09 | 15 | 01 | 41 |
| | 15 | 18 | 38 | 50.47 | 26 | 55 | 10.8 | 0.545 324 | 16.13 | 15.29 | 15 | 01 | 33 |
| | 16 | 18 | 42 | 38.10 | -26 | 50 | 23.7 | 0.537 882 | 16.35 | 15.51 | 15 | 01 | 22 |

**VENUS, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Nov | 16 | 18 | 42 | 38.10 | -26 | 50 | 23.7 | 0.537 882 | 16.35 | 15.51 | 15 | 01 | 22 |
| | 17 | 18 | 46 | 22.03 | 26 | 45 | 07.1 | 0.530 463 | 16.58 | 15.72 | 15 | 01 | 07 |
| | 18 | 18 | 50 | 02.10 | 26 | 39 | 21.7 | 0.523 069 | 16.81 | 15.94 | 15 | 00 | 48 |
| | 19 | 18 | 53 | 38.15 | 26 | 33 | 08.4 | 0.515 703 | 17.05 | 16.17 | 15 | 00 | 25 |
| | 20 | 18 | 57 | 10.02 | 26 | 26 | 27.9 | 0.508 367 | 17.30 | 16.41 | 14 | 59 | 57 |
| | 21 | 19 | 00 | 37.53 | 26 | 19 | 21.0 | 0.501 062 | 17.55 | 16.64 | 14 | 59 | 26 |
| | 22 | 19 | 04 | 00.50 | -26 | 11 | 48.7 | 0.493 791 | 17.81 | 16.89 | 14 | 58 | 49 |
| | 23 | 19 | 07 | 18.78 | 26 | 03 | 51.7 | 0.486 556 | 18.07 | 17.14 | 14 | 58 | 08 |
| | 24 | 19 | 10 | 32.17 | 25 | 55 | 31.1 | 0.479 359 | 18.35 | 17.40 | 14 | 57 | 22 |
| | 25 | 19 | 13 | 40.49 | 25 | 46 | 47.7 | 0.472 203 | 18.62 | 17.66 | 14 | 56 | 30 |
| | 26 | 19 | 16 | 43.56 | 25 | 37 | 42.4 | 0.465 090 | 18.91 | 17.93 | 14 | 55 | 33 |
| | 27 | 19 | 19 | 41.18 | 25 | 28 | 16.3 | 0.458 022 | 19.20 | 18.21 | 14 | 54 | 31 |
| | 28 | 19 | 22 | 33.17 | -25 | 18 | 30.2 | 0.451 003 | 19.50 | 18.49 | 14 | 53 | 23 |
| | 29 | 19 | 25 | 19.31 | 25 | 08 | 25.2 | 0.444 036 | 19.81 | 18.78 | 14 | 52 | 09 |
| | 30 | 19 | 27 | 59.41 | 24 | 58 | 02.3 | 0.437 122 | 20.12 | 19.08 | 14 | 50 | 49 |
| Dec | 1 | 19 | 30 | 33.26 | 24 | 47 | 22.6 | 0.430 265 | 20.44 | 19.38 | 14 | 49 | 22 |
| | 2 | 19 | 33 | 00.64 | 24 | 36 | 26.9 | 0.423 467 | 20.77 | 19.69 | 14 | 47 | 49 |
| | 3 | 19 | 35 | 21.32 | 24 | 25 | 16.5 | 0.416 733 | 21.10 | 20.01 | 14 | 46 | 09 |
| | 4 | 19 | 37 | 35.07 | -24 | 13 | 52.4 | 0.410 066 | 21.45 | 20.34 | 14 | 44 | 22 |
| | 5 | 19 | 39 | 41.65 | 24 | 02 | 15.7 | 0.403 468 | 21.80 | 20.67 | 14 | 42 | 27 |
| | 6 | 19 | 41 | 40.79 | 23 | 50 | 27.5 | 0.396 945 | 22.15 | 21.01 | 14 | 40 | 25 |
| | 7 | 19 | 43 | 32.23 | 23 | 38 | 29.0 | 0.390 500 | 22.52 | 21.36 | 14 | 38 | 16 |
| | 8 | 19 | 45 | 15.71 | 23 | 26 | 21.3 | 0.384 139 | 22.89 | 21.71 | 14 | 35 | 58 |
| | 9 | 19 | 46 | 50.95 | 23 | 14 | 05.5 | 0.377 865 | 23.27 | 22.07 | 14 | 33 | 32 |
| | 10 | 19 | 48 | 17.70 | -23 | 01 | 42.8 | 0.371 685 | 23.66 | 22.44 | 14 | 30 | 57 |
| | 11 | 19 | 49 | 35.68 | 22 | 49 | 14.3 | 0.365 604 | 24.05 | 22.81 | 14 | 28 | 13 |
| | 12 | 19 | 50 | 44.65 | 22 | 36 | 41.0 | 0.359 629 | 24.45 | 23.19 | 14 | 25 | 20 |
| | 13 | 19 | 51 | 44.34 | 22 | 24 | 04.2 | 0.353 765 | 24.86 | 23.57 | 14 | 22 | 18 |
| | 14 | 19 | 52 | 34.53 | 22 | 11 | 24.8 | 0.348 020 | 25.27 | 23.96 | 14 | 19 | 06 |
| | 15 | 19 | 53 | 14.98 | 21 | 58 | 44.1 | 0.342 400 | 25.68 | 24.36 | 14 | 15 | 45 |
| | 16 | 19 | 53 | 45.48 | -21 | 46 | 02.9 | 0.336 912 | 26.10 | 24.75 | 14 | 12 | 13 |
| | 17 | 19 | 54 | 05.83 | 21 | 33 | 22.5 | 0.331 564 | 26.52 | 25.15 | 14 | 08 | 32 |
| | 18 | 19 | 54 | 15.86 | 21 | 20 | 43.8 | 0.326 364 | 26.95 | 25.55 | 14 | 04 | 40 |
| | 19 | 19 | 54 | 15.42 | 21 | 08 | 07.8 | 0.321 320 | 27.37 | 25.96 | 14 | 00 | 37 |
| | 20 | 19 | 54 | 04.40 | 20 | 55 | 35.4 | 0.316 439 | 27.79 | 26.36 | 13 | 56 | 24 |
| | 21 | 19 | 53 | 42.71 | 20 | 43 | 07.5 | 0.311 730 | 28.21 | 26.75 | 13 | 52 | 00 |
| | 22 | 19 | 53 | 10.31 | -20 | 30 | 45.2 | 0.307 202 | 28.63 | 27.15 | 13 | 47 | 26 |
| | 23 | 19 | 52 | 27.23 | 20 | 18 | 29.1 | 0.302 864 | 29.04 | 27.54 | 13 | 42 | 41 |
| | 24 | 19 | 51 | 33.52 | 20 | 06 | 20.2 | 0.298 723 | 29.44 | 27.92 | 13 | 37 | 46 |
| | 25 | 19 | 50 | 29.30 | 19 | 54 | 19.2 | 0.294 790 | 29.83 | 28.29 | 13 | 32 | 41 |
| | 26 | 19 | 49 | 14.77 | 19 | 42 | 27.0 | 0.291 072 | 30.21 | 28.65 | 13 | 27 | 25 |
| | 27 | 19 | 47 | 50.17 | 19 | 30 | 44.4 | 0.287 578 | 30.58 | 29.00 | 13 | 21 | 60 |
| | 28 | 19 | 46 | 15.83 | -19 | 19 | 12.0 | 0.284 316 | 30.93 | 29.33 | 13 | 16 | 25 |
| | 29 | 19 | 44 | 32.16 | 19 | 07 | 50.8 | 0.281 295 | 31.26 | 29.65 | 13 | 10 | 41 |
| | 30 | 19 | 42 | 39.63 | 18 | 56 | 41.5 | 0.278 522 | 31.57 | 29.94 | 13 | 04 | 49 |
| | 31 | 19 | 40 | 38.79 | 18 | 45 | 44.9 | 0.276 005 | 31.86 | 30.22 | 12 | 58 | 49 |
| | 32 | 19 | 38 | 30.27 | -18 | 35 | 02.1 | 0.273 751 | 32.12 | 30.47 | 12 | 52 | 41 |

**MARS, 2021**

HELIOCENTRIC POSITIONS FOR $0^h$ TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

| Date | | Heliocentric Longitude | | | Heliocentric Latitude | | | Radius Vector | Date | | Heliocentric Longitude | | | Heliocentric Latitude | | | Radius Vector |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | | ° | ' | " | ° | ' | " | |
| Jan. | 1 | 66 | 00 | 09.2 | +0 | 31 | 07.6 | 1.509 3541 | Apr. | 3 | 111 | 28 | 53.1 | +1 | 37 | 46.3 | 1.617 2389 |
| | 3 | 67 | 03 | 49.4 | 0 | 33 | 05.7 | 1.511 9668 | | 5 | 112 | 24 | 25.1 | 1 | 38 | 36.4 | 1.619 0702 |
| | 5 | 68 | 07 | 16.5 | 0 | 35 | 02.7 | 1.514 5790 | | 7 | 113 | 19 | 49.8 | 1 | 39 | 24.8 | 1.620 8713 |
| | 7 | 69 | 10 | 30.6 | 0 | 36 | 58.6 | 1.517 1897 | | 9 | 114 | 15 | 07.1 | 1 | 40 | 11.6 | 1.622 6418 |
| | 9 | 70 | 13 | 31.6 | 0 | 38 | 53.3 | 1.519 7982 | | 11 | 115 | 10 | 17.4 | 1 | 40 | 56.8 | 1.624 3811 |
| | 11 | 71 | 16 | 19.7 | 0 | 40 | 46.8 | 1.522 4034 | | 13 | 116 | 05 | 20.7 | 1 | 41 | 40.2 | 1.626 0890 |
| | 13 | 72 | 18 | 55.1 | +0 | 42 | 39.2 | 1.525 0046 | | 15 | 117 | 00 | 17.1 | +1 | 42 | 22.1 | 1.627 7651 |
| | 15 | 73 | 21 | 17.7 | 0 | 44 | 30.3 | 1.527 6010 | | 17 | 117 | 55 | 06.9 | 1 | 43 | 02.3 | 1.629 4090 |
| | 17 | 74 | 23 | 27.7 | 0 | 46 | 20.2 | 1.530 1916 | | 19 | 118 | 49 | 50.2 | 1 | 43 | 40.8 | 1.631 0204 |
| | 19 | 75 | 25 | 25.1 | 0 | 48 | 08.8 | 1.532 7757 | | 21 | 119 | 44 | 27.0 | 1 | 44 | 17.8 | 1.632 5990 |
| | 21 | 76 | 27 | 10.2 | 0 | 49 | 56.1 | 1.535 3525 | | 23 | 120 | 38 | 57.7 | 1 | 44 | 53.0 | 1.634 1443 |
| | 23 | 77 | 28 | 42.8 | 0 | 51 | 42.1 | 1.537 9210 | | 25 | 121 | 33 | 22.2 | 1 | 45 | 26.6 | 1.635 6561 |
| | 25 | 78 | 30 | 03.3 | +0 | 53 | 26.7 | 1.540 4807 | | 27 | 122 | 27 | 40.9 | +1 | 45 | 58.6 | 1.637 1340 |
| | 27 | 79 | 31 | 11.6 | 0 | 55 | 10.0 | 1.543 0306 | | 29 | 123 | 21 | 53.8 | 1 | 46 | 29.0 | 1.638 5778 |
| | 29 | 80 | 32 | 07.9 | 0 | 56 | 51.9 | 1.545 5700 | May | 1 | 124 | 16 | 01.0 | 1 | 46 | 57.7 | 1.639 9871 |
| | 31 | 81 | 32 | 52.3 | 0 | 58 | 32.4 | 1.548 0981 | | 3 | 125 | 10 | 02.7 | 1 | 47 | 24.8 | 1.641 3617 |
| Feb. | 2 | 82 | 33 | 24.9 | 1 | 00 | 11.4 | 1.550 6142 | | 5 | 126 | 03 | 59.1 | 1 | 47 | 50.2 | 1.642 7013 |
| | 4 | 83 | 33 | 45.8 | 1 | 01 | 49.1 | 1.553 1176 | | 7 | 126 | 57 | 50.4 | 1 | 48 | 14.0 | 1.644 0055 |
| | 6 | 84 | 33 | 55.1 | +1 | 03 | 25.3 | 1.555 6074 | | 9 | 127 | 51 | 36.6 | +1 | 48 | 36.2 | 1.645 2743 |
| | 8 | 85 | 33 | 53.1 | 1 | 05 | 00.0 | 1.558 0831 | | 11 | 128 | 45 | 18.0 | 1 | 48 | 56.8 | 1.646 5072 |
| | 10 | 86 | 33 | 39.7 | 1 | 06 | 33.2 | 1.560 5438 | | 13 | 129 | 38 | 54.6 | 1 | 49 | 15.7 | 1.647 7040 |
| | 12 | 87 | 33 | 15.1 | 1 | 08 | 05.0 | 1.562 9890 | | 15 | 130 | 32 | 26.6 | 1 | 49 | 33.0 | 1.648 8646 |
| | 14 | 88 | 32 | 39.4 | 1 | 09 | 35.3 | 1.565 4178 | | 17 | 131 | 25 | 54.2 | 1 | 49 | 48.7 | 1.649 9886 |
| | 16 | 89 | 31 | 52.8 | 1 | 11 | 04.0 | 1.567 8297 | | 19 | 132 | 19 | 17.5 | 1 | 50 | 02.9 | 1.651 0759 |
| | 18 | 90 | 30 | 55.4 | +1 | 12 | 31.2 | 1.570 2240 | | 21 | 133 | 12 | 36.7 | +1 | 50 | 15.3 | 1.652 1262 |
| | 20 | 91 | 29 | 47.3 | 1 | 13 | 56.8 | 1.572 6000 | | 23 | 134 | 05 | 51.9 | 1 | 50 | 26.2 | 1.653 1393 |
| | 22 | 92 | 28 | 28.7 | 1 | 15 | 20.9 | 1.574 9571 | | 25 | 134 | 59 | 03.2 | 1 | 50 | 35.5 | 1.654 1151 |
| | 24 | 93 | 26 | 59.6 | 1 | 16 | 43.5 | 1.577 2946 | | 27 | 135 | 52 | 10.9 | 1 | 50 | 43.2 | 1.655 0534 |
| | 26 | 94 | 25 | 20.3 | 1 | 18 | 04.4 | 1.579 6120 | | 29 | 136 | 45 | 15.1 | 1 | 50 | 49.3 | 1.655 9539 |
| | 28 | 95 | 23 | 30.8 | 1 | 19 | 23.8 | 1.581 9086 | | 31 | 137 | 38 | 15.9 | 1 | 50 | 53.8 | 1.656 8165 |
| Mar. | 2 | 96 | 21 | 31.3 | +1 | 20 | 41.6 | 1.584 1839 | June | 2 | 138 | 31 | 13.4 | +1 | 50 | 56.8 | 1.657 6410 |
| | 4 | 97 | 19 | 21.9 | 1 | 21 | 57.9 | 1.586 4372 | | 4 | 139 | 24 | 07.9 | 1 | 50 | 58.1 | 1.658 4273 |
| | 6 | 98 | 17 | 02.8 | 1 | 23 | 12.5 | 1.588 6680 | | 6 | 140 | 16 | 59.4 | 1 | 50 | 57.9 | 1.659 1752 |
| | 8 | 99 | 14 | 34.1 | 1 | 24 | 25.5 | 1.590 8758 | | 8 | 141 | 09 | 48.1 | 1 | 50 | 56.2 | 1.659 8846 |
| | 10 | 100 | 11 | 56.0 | 1 | 25 | 36.8 | 1.593 0599 | | 10 | 142 | 02 | 34.2 | 1 | 50 | 52.8 | 1.660 5553 |
| | 12 | 101 | 09 | 08.5 | 1 | 26 | 46.6 | 1.595 2198 | | 12 | 142 | 55 | 17.8 | 1 | 50 | 47.9 | 1.661 1873 |
| | 14 | 102 | 06 | 11.9 | +1 | 27 | 54.8 | 1.597 3550 | | 14 | 143 | 47 | 59.1 | +1 | 50 | 41.4 | 1.661 7804 |
| | 16 | 103 | 03 | 06.3 | 1 | 29 | 01.3 | 1.599 4650 | | 16 | 144 | 40 | 38.2 | 1 | 50 | 33.4 | 1.662 3344 |
| | 18 | 103 | 59 | 51.7 | 1 | 30 | 06.2 | 1.601 5492 | | 18 | 145 | 33 | 15.2 | 1 | 50 | 23.8 | 1.662 8493 |
| | 20 | 104 | 56 | 28.4 | 1 | 31 | 09.5 | 1.603 6072 | | 20 | 146 | 25 | 50.4 | 1 | 50 | 12.7 | 1.663 3251 |
| | 22 | 105 | 52 | 56.6 | 1 | 32 | 11.1 | 1.605 6385 | | 22 | 147 | 18 | 23.8 | 1 | 50 | 00.1 | 1.663 7615 |
| | 24 | 106 | 49 | 16.3 | 1 | 33 | 11.0 | 1.607 6426 | | 24 | 148 | 10 | 55.6 | 1 | 49 | 45.8 | 1.664 1585 |
| | 26 | 107 | 45 | 27.6 | +1 | 34 | 09.4 | 1.609 6190 | | 26 | 149 | 03 | 26.0 | +1 | 49 | 30.2 | 1.664 5161 |
| | 28 | 108 | 41 | 30.9 | 1 | 35 | 06.1 | 1.611 5673 | | 28 | 149 | 55 | 55.0 | 1 | 49 | 12.9 | 1.664 8342 |
| | 30 | 109 | 37 | 26.1 | 1 | 36 | 01.1 | 1.613 4870 | | 30 | 150 | 48 | 23.0 | 1 | 48 | 54.1 | 1.665 1126 |
| Apr. | 1 | 110 | 33 | 13.4 | 1 | 36 | 54.5 | 1.615 3776 | July | 2 | 151 | 40 | 49.9 | 1 | 48 | 33.9 | 1.665 3515 |
| | 3 | 111 | 28 | 53.1 | +1 | 37 | 46.3 | 1.617 2389 | | 4 | 152 | 33 | 16.0 | +1 | 48 | 12.1 | 1.665 5506 |

**MARS, 2021**

HELIOCENTRIC POSITIONS FOR $0^h$ TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

| Date | | Heliocentric Longitude | | | Heliocentric Latitude | | | Radius Vector | Date | | Heliocentric Longitude | | | Heliocentric Latitude | | | Radius Vector |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ′ | ″ | ° | ′ | ″ | | | | ° | ′ | ″ | ° | ′ | ″ | |
| July | 2 | 151 | 40 | 49.9 | +1 | 48 | 33.9 | 1.665 3515 | Oct. | 2 | 192 | 18 | 31.4 | +1 | 07 | 26.3 | 1.634 1667 |
| | 4 | 152 | 33 | 16.0 | 1 | 48 | 12.1 | 1.665 5506 | | 4 | 193 | 13 | 00.1 | 1 | 06 | 02.0 | 1.632 6216 |
| | 6 | 153 | 25 | 41.4 | 1 | 47 | 48.8 | 1.665 7101 | | 6 | 194 | 07 | 34.9 | 1 | 04 | 36.6 | 1.631 0432 |
| | 8 | 154 | 18 | 06.2 | 1 | 47 | 24.0 | 1.665 8298 | | 8 | 195 | 02 | 16.2 | 1 | 03 | 09.9 | 1.629 4320 |
| | 10 | 155 | 10 | 30.7 | 1 | 46 | 57.7 | 1.665 9097 | | 10 | 195 | 57 | 03.9 | 1 | 01 | 42.2 | 1.627 7881 |
| | 12 | 156 | 02 | 54.8 | 1 | 46 | 30.0 | 1.665 9499 | | 12 | 196 | 51 | 58.3 | 1 | 00 | 13.3 | 1.626 1121 |
| | 14 | 156 | 55 | 18.9 | +1 | 46 | 00.7 | 1.665 9502 | | 14 | 197 | 46 | 59.5 | +0 | 58 | 43.4 | 1.624 4043 |
| | 16 | 157 | 47 | 43.0 | 1 | 45 | 30.0 | 1.665 9108 | | 16 | 198 | 42 | 07.7 | 0 | 57 | 12.3 | 1.622 6649 |
| | 18 | 158 | 40 | 07.3 | 1 | 44 | 57.8 | 1.665 8316 | | 18 | 199 | 37 | 23.0 | 0 | 55 | 40.1 | 1.620 8945 |
| | 20 | 159 | 32 | 32.0 | 1 | 44 | 24.1 | 1.665 7126 | | 20 | 200 | 32 | 45.5 | 0 | 54 | 06.9 | 1.619 0933 |
| | 22 | 160 | 24 | 57.2 | 1 | 43 | 49.0 | 1.665 5539 | | 22 | 201 | 28 | 15.4 | 0 | 52 | 32.6 | 1.617 2619 |
| | 24 | 161 | 17 | 22.9 | 1 | 43 | 12.4 | 1.665 3555 | | 24 | 202 | 23 | 52.9 | 0 | 50 | 57.3 | 1.615 4005 |
| | 26 | 162 | 09 | 49.5 | +1 | 42 | 34.3 | 1.665 1174 | | 26 | 203 | 19 | 38.1 | +0 | 49 | 21.0 | 1.613 5097 |
| | 28 | 163 | 02 | 17.0 | 1 | 41 | 54.9 | 1.664 8396 | | 28 | 204 | 15 | 31.2 | 0 | 47 | 43.6 | 1.611 5898 |
| | 30 | 163 | 54 | 45.6 | 1 | 41 | 13.9 | 1.664 5223 | | 30 | 205 | 11 | 32.3 | 0 | 46 | 05.3 | 1.609 6413 |
| Aug. | 1 | 164 | 47 | 15.5 | 1 | 40 | 31.6 | 1.664 1654 | Nov. | 1 | 206 | 07 | 41.6 | 0 | 44 | 26.0 | 1.607 6647 |
| | 3 | 165 | 39 | 46.7 | 1 | 39 | 47.9 | 1.663 7691 | | 3 | 207 | 03 | 59.2 | 0 | 42 | 45.7 | 1.605 6603 |
| | 5 | 166 | 32 | 19.4 | 1 | 39 | 02.7 | 1.663 3333 | | 5 | 208 | 00 | 25.2 | 0 | 41 | 04.5 | 1.603 6287 |
| | 7 | 167 | 24 | 53.9 | +1 | 38 | 16.0 | 1.662 8583 | | 7 | 208 | 56 | 59.8 | +0 | 39 | 22.3 | 1.601 5703 |
| | 9 | 168 | 17 | 30.2 | 1 | 37 | 28.0 | 1.662 3441 | | 9 | 209 | 53 | 43.2 | 0 | 37 | 39.2 | 1.599 4856 |
| | 11 | 169 | 10 | 08.4 | 1 | 36 | 38.6 | 1.661 7907 | | 11 | 210 | 50 | 35.5 | 0 | 35 | 55.3 | 1.597 3752 |
| | 13 | 170 | 02 | 48.8 | 1 | 35 | 47.8 | 1.661 1983 | | 13 | 211 | 47 | 36.8 | 0 | 34 | 10.5 | 1.595 2395 |
| | 15 | 170 | 55 | 31.5 | 1 | 34 | 55.6 | 1.660 5670 | | 15 | 212 | 44 | 47.3 | 0 | 32 | 24.8 | 1.593 0791 |
| | 17 | 171 | 48 | 16.6 | 1 | 34 | 02.0 | 1.659 8968 | | 17 | 213 | 42 | 07.2 | 0 | 30 | 38.3 | 1.590 8944 |
| | 19 | 172 | 41 | 04.3 | +1 | 33 | 07.1 | 1.659 1881 | | 19 | 214 | 39 | 36.5 | +0 | 28 | 51.0 | 1.588 6861 |
| | 21 | 173 | 33 | 54.7 | 1 | 32 | 10.8 | 1.658 4408 | | 21 | 215 | 37 | 15.4 | 0 | 27 | 02.9 | 1.586 4546 |
| | 23 | 174 | 26 | 48.0 | 1 | 31 | 13.1 | 1.657 6551 | | 23 | 216 | 35 | 04.1 | 0 | 25 | 14.1 | 1.584 2006 |
| | 25 | 175 | 19 | 44.4 | 1 | 30 | 14.1 | 1.656 8311 | | 25 | 217 | 33 | 02.7 | 0 | 23 | 24.5 | 1.581 9246 |
| | 27 | 176 | 12 | 43.9 | 1 | 29 | 13.7 | 1.655 9691 | | 27 | 218 | 31 | 11.4 | 0 | 21 | 34.2 | 1.579 6272 |
| | 29 | 177 | 05 | 46.7 | 1 | 28 | 12.0 | 1.655 0692 | | 29 | 219 | 29 | 30.2 | 0 | 19 | 43.2 | 1.577 3090 |
| | 31 | 177 | 58 | 53.1 | +1 | 27 | 09.0 | 1.654 1315 | Dec. | 1 | 220 | 27 | 59.3 | +0 | 17 | 51.5 | 1.574 9706 |
| Sept. | 2 | 178 | 52 | 03.0 | 1 | 26 | 04.6 | 1.653 1562 | | 3 | 221 | 26 | 38.9 | 0 | 15 | 59.2 | 1.572 6126 |
| | 4 | 179 | 45 | 16.8 | 1 | 24 | 58.9 | 1.652 1436 | | 5 | 222 | 25 | 29.1 | 0 | 14 | 06.3 | 1.570 2357 |
| | 6 | 180 | 38 | 34.5 | 1 | 23 | 51.9 | 1.651 0937 | | 7 | 223 | 24 | 30.1 | 0 | 12 | 12.8 | 1.567 8405 |
| | 8 | 181 | 31 | 56.3 | 1 | 22 | 43.6 | 1.650 0069 | | 9 | 224 | 23 | 41.9 | 0 | 10 | 18.6 | 1.565 4276 |
| | 10 | 182 | 25 | 22.3 | 1 | 21 | 34.1 | 1.648 8834 | | 11 | 225 | 23 | 04.7 | 0 | 08 | 24.0 | 1.562 9977 |
| | 12 | 183 | 18 | 52.7 | +1 | 20 | 23.2 | 1.647 7233 | | 13 | 226 | 22 | 38.6 | +0 | 06 | 28.9 | 1.560 5514 |
| | 14 | 184 | 12 | 27.6 | 1 | 19 | 11.1 | 1.646 5268 | | 15 | 227 | 22 | 23.7 | 0 | 04 | 33.3 | 1.558 0895 |
| | 16 | 185 | 06 | 07.3 | 1 | 17 | 57.7 | 1.645 2943 | | 17 | 228 | 22 | 20.2 | 0 | 02 | 37.2 | 1.555 6127 |
| | 18 | 185 | 59 | 51.8 | 1 | 16 | 43.1 | 1.644 0260 | | 19 | 229 | 22 | 28.2 | +0 | 00 | 40.7 | 1.553 1217 |
| | 20 | 186 | 53 | 41.2 | 1 | 15 | 27.2 | 1.642 7221 | | 21 | 230 | 22 | 47.9 | -0 | 01 | 16.2 | 1.550 6171 |
| | 22 | 187 | 47 | 35.9 | 1 | 14 | 10.1 | 1.641 3828 | | 23 | 231 | 23 | 19.3 | 0 | 03 | 13.4 | 1.548 0997 |
| | 24 | 188 | 41 | 35.8 | +1 | 12 | 51.7 | 1.640 0085 | | 25 | 232 | 24 | 02.5 | -0 | 05 | 11.0 | 1.545 5702 |
| | 26 | 189 | 35 | 41.1 | 1 | 11 | 32.2 | 1.638 5995 | | 27 | 233 | 24 | 57.7 | 0 | 07 | 08.8 | 1.543 0295 |
| | 28 | 190 | 29 | 52.1 | 1 | 10 | 11.4 | 1.637 1560 | | 29 | 234 | 26 | 05.1 | 0 | 09 | 06.9 | 1.540 4782 |
| | 30 | 191 | 24 | 08.8 | 1 | 08 | 49.5 | 1.635 6783 | | 31 | 235 | 27 | 24.6 | 0 | 11 | 05.3 | 1.537 9172 |
| Oct. | 2 | 192 | 18 | 31.4 | +1 | 07 | 26.3 | 1.634 1667 | | 33 | 236 | 28 | 56.4 | -0 | 13 | 03.8 | 1.535 3471 |

**MARS, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| Jan. | 0 | 26 | 55 | 40.7 | +0 | 51 | 05.5 | Feb. | 15 | 50 | 12 | 57.4 | +1 | 22 | 52.9 |
| | 1 | 27 | 21 | 26.5 | 0 | 52 | 17.3 | | 16 | 50 | 46 | 35.2 | 1 | 23 | 12.0 |
| | 2 | 27 | 47 | 29.3 | 0 | 53 | 27.3 | | 17 | 51 | 20 | 18.3 | 1 | 23 | 30.4 |
| | 3 | 28 | 13 | 48.8 | 0 | 54 | 35.4 | | 18 | 51 | 54 | 06.6 | 1 | 23 | 48.3 |
| | 4 | 28 | 40 | 24.4 | 0 | 55 | 41.8 | | 19 | 52 | 27 | 59.8 | 1 | 24 | 05.5 |
| | 5 | 29 | 07 | 15.9 | 0 | 56 | 46.4 | | 20 | 53 | 01 | 57.9 | 1 | 24 | 22.1 |
| | 6 | 29 | 34 | 22.9 | +0 | 57 | 49.3 | | 21 | 53 | 36 | 00.7 | +1 | 24 | 38.1 |
| | 7 | 30 | 01 | 45.2 | 0 | 58 | 50.6 | | 22 | 54 | 10 | 07.9 | 1 | 24 | 53.6 |
| | 8 | 30 | 29 | 22.3 | 0 | 59 | 50.2 | | 23 | 54 | 44 | 19.4 | 1 | 25 | 08.4 |
| | 9 | 30 | 57 | 14.1 | 1 | 00 | 48.2 | | 24 | 55 | 18 | 35.1 | 1 | 25 | 22.7 |
| | 10 | 31 | 25 | 20.3 | 1 | 01 | 44.8 | | 25 | 55 | 52 | 54.8 | 1 | 25 | 36.4 |
| | 11 | 31 | 53 | 40.5 | 1 | 02 | 39.8 | | 26 | 56 | 27 | 18.3 | 1 | 25 | 49.6 |
| | 12 | 32 | 22 | 14.4 | +1 | 03 | 33.4 | | 27 | 57 | 01 | 45.5 | +1 | 26 | 02.2 |
| | 13 | 32 | 51 | 01.7 | 1 | 04 | 25.5 | | 28 | 57 | 36 | 16.3 | 1 | 26 | 14.3 |
| | 14 | 33 | 20 | 02.0 | 1 | 05 | 16.3 | Mar. | 1 | 58 | 10 | 50.7 | 1 | 26 | 25.8 |
| | 15 | 33 | 49 | 14.9 | 1 | 06 | 05.8 | | 2 | 58 | 45 | 28.6 | 1 | 26 | 36.8 |
| | 16 | 34 | 18 | 40.2 | 1 | 06 | 54.0 | | 3 | 59 | 20 | 09.9 | 1 | 26 | 47.3 |
| | 17 | 34 | 48 | 17.4 | 1 | 07 | 40.9 | | 4 | 59 | 54 | 54.6 | 1 | 26 | 57.3 |
| | 18 | 35 | 18 | 06.2 | +1 | 08 | 26.6 | | 5 | 60 | 29 | 42.8 | +1 | 27 | 06.8 |
| | 19 | 35 | 48 | 06.3 | 1 | 09 | 11.1 | | 6 | 61 | 04 | 34.4 | 1 | 27 | 15.8 |
| | 20 | 36 | 18 | 17.4 | 1 | 09 | 54.4 | | 7 | 61 | 39 | 29.2 | 1 | 27 | 24.4 |
| | 21 | 36 | 48 | 39.2 | 1 | 10 | 36.6 | | 8 | 62 | 14 | 27.4 | 1 | 27 | 32.5 |
| | 22 | 37 | 19 | 11.3 | 1 | 11 | 17.6 | | 9 | 62 | 49 | 28.6 | 1 | 27 | 40.2 |
| | 23 | 37 | 49 | 53.4 | 1 | 11 | 57.5 | | 10 | 63 | 24 | 33.0 | 1 | 27 | 47.5 |
| | 24 | 38 | 20 | 45.2 | +1 | 12 | 36.4 | | 11 | 63 | 59 | 40.4 | +1 | 27 | 54.3 |
| | 25 | 38 | 51 | 46.4 | 1 | 13 | 14.1 | | 12 | 64 | 34 | 50.8 | 1 | 28 | 00.8 |
| | 26 | 39 | 22 | 56.8 | 1 | 13 | 50.9 | | 13 | 65 | 10 | 04.0 | 1 | 28 | 06.9 |
| | 27 | 39 | 54 | 16.0 | 1 | 14 | 26.5 | | 14 | 65 | 45 | 20.1 | 1 | 28 | 12.6 |
| | 28 | 40 | 25 | 43.7 | 1 | 15 | 01.2 | | 15 | 66 | 20 | 38.9 | 1 | 28 | 17.9 |
| | 29 | 40 | 57 | 19.7 | 1 | 15 | 34.9 | | 16 | 66 | 56 | 00.5 | 1 | 28 | 22.8 |
| | 30 | 41 | 29 | 03.7 | +1 | 16 | 07.5 | | 17 | 67 | 31 | 24.6 | +1 | 28 | 27.4 |
| | 31 | 42 | 00 | 55.6 | 1 | 16 | 39.2 | | 18 | 68 | 06 | 51.2 | 1 | 28 | 31.7 |
| Feb. | 1 | 42 | 32 | 55.1 | 1 | 17 | 10.0 | | 19 | 68 | 42 | 20.2 | 1 | 28 | 35.5 |
| | 2 | 43 | 05 | 02.1 | 1 | 17 | 39.8 | | 20 | 69 | 17 | 51.6 | 1 | 28 | 39.1 |
| | 3 | 43 | 37 | 16.4 | 1 | 18 | 08.7 | | 21 | 69 | 53 | 25.2 | 1 | 28 | 42.3 |
| | 4 | 44 | 09 | 38.1 | 1 | 18 | 36.8 | | 22 | 70 | 29 | 00.9 | 1 | 28 | 45.1 |
| | 5 | 44 | 42 | 06.8 | +1 | 19 | 03.9 | | 23 | 71 | 04 | 38.6 | +1 | 28 | 47.6 |
| | 6 | 45 | 14 | 42.7 | 1 | 19 | 30.2 | | 24 | 71 | 40 | 18.3 | 1 | 28 | 49.7 |
| | 7 | 45 | 47 | 25.4 | 1 | 19 | 55.7 | | 25 | 72 | 15 | 59.8 | 1 | 28 | 51.6 |
| | 8 | 46 | 20 | 14.9 | 1 | 20 | 20.4 | | 26 | 72 | 51 | 43.0 | 1 | 28 | 53.0 |
| | 9 | 46 | 53 | 11.1 | 1 | 20 | 44.3 | | 27 | 73 | 27 | 27.8 | 1 | 28 | 54.2 |
| | 10 | 47 | 26 | 13.6 | 1 | 21 | 07.5 | | 28 | 74 | 03 | 14.3 | 1 | 28 | 55.0 |
| | 11 | 47 | 59 | 22.5 | +1 | 21 | 30.0 | | 29 | 74 | 39 | 02.4 | +1 | 28 | 55.5 |
| | 12 | 48 | 32 | 37.4 | 1 | 21 | 51.7 | | 30 | 75 | 14 | 52.0 | 1 | 28 | 55.7 |
| | 13 | 49 | 05 | 58.3 | 1 | 22 | 12.8 | | 31 | 75 | 50 | 43.3 | 1 | 28 | 55.5 |
| | 14 | 49 | 39 | 25.0 | 1 | 22 | 33.2 | Apr. | 1 | 76 | 26 | 36.1 | 1 | 28 | 55.1 |
| | 15 | 50 | 12 | 57.4 | +1 | 22 | 52.9 | | 2 | 77 | 02 | 30.6 | +1 | 28 | 54.3 |

**MARS, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|
| | | ° | ′ | ″ | ° | ′ | ″ |
| Apr. | 1 | 76 | 26 | 36.1 | +1 | 28 | 55.1 |
| | 2 | 77 | 02 | 30.6 | 1 | 28 | 54.3 |
| | 3 | 77 | 38 | 26.7 | 1 | 28 | 53.3 |
| | 4 | 78 | 14 | 24.4 | 1 | 28 | 52.0 |
| | 5 | 78 | 50 | 23.6 | 1 | 28 | 50.4 |
| | 6 | 79 | 26 | 24.4 | 1 | 28 | 48.6 |
| | 7 | 80 | 02 | 26.7 | +1 | 28 | 46.5 |
| | 8 | 80 | 38 | 30.4 | 1 | 28 | 44.2 |
| | 9 | 81 | 14 | 35.6 | 1 | 28 | 41.6 |
| | 10 | 81 | 50 | 42.3 | 1 | 28 | 38.8 |
| | 11 | 82 | 26 | 50.4 | 1 | 28 | 35.7 |
| | 12 | 83 | 02 | 59.9 | 1 | 28 | 32.5 |
| | 13 | 83 | 39 | 10.7 | +1 | 28 | 29.0 |
| | 14 | 84 | 15 | 22.9 | 1 | 28 | 25.2 |
| | 15 | 84 | 51 | 36.5 | 1 | 28 | 21.3 |
| | 16 | 85 | 27 | 51.2 | 1 | 28 | 17.1 |
| | 17 | 86 | 04 | 07.1 | 1 | 28 | 12.7 |
| | 18 | 86 | 40 | 24.2 | 1 | 28 | 08.1 |
| | 19 | 87 | 16 | 42.3 | +1 | 28 | 03.3 |
| | 20 | 87 | 53 | 01.4 | 1 | 27 | 58.2 |
| | 21 | 88 | 29 | 21.4 | 1 | 27 | 52.9 |
| | 22 | 89 | 05 | 42.3 | 1 | 27 | 47.4 |
| | 23 | 89 | 42 | 03.9 | 1 | 27 | 41.7 |
| | 24 | 90 | 18 | 26.3 | 1 | 27 | 35.7 |
| | 25 | 90 | 54 | 49.5 | +1 | 27 | 29.5 |
| | 26 | 91 | 31 | 13.4 | 1 | 27 | 23.2 |
| | 27 | 92 | 07 | 38.1 | 1 | 27 | 16.6 |
| | 28 | 92 | 44 | 03.6 | 1 | 27 | 09.7 |
| | 29 | 93 | 20 | 29.9 | 1 | 27 | 02.7 |
| | 30 | 93 | 56 | 57.0 | 1 | 26 | 55.5 |
| May | 1 | 94 | 33 | 25.0 | +1 | 26 | 48.1 |
| | 2 | 95 | 09 | 53.7 | 1 | 26 | 40.6 |
| | 3 | 95 | 46 | 23.3 | 1 | 26 | 32.8 |
| | 4 | 96 | 22 | 53.7 | 1 | 26 | 24.9 |
| | 5 | 96 | 59 | 25.0 | 1 | 26 | 16.8 |
| | 6 | 97 | 35 | 57.1 | 1 | 26 | 08.6 |
| | 7 | 98 | 12 | 30.0 | +1 | 26 | 00.1 |
| | 8 | 98 | 49 | 03.8 | 1 | 25 | 51.6 |
| | 9 | 99 | 25 | 38.5 | 1 | 25 | 42.8 |
| | 10 | 100 | 02 | 14.0 | 1 | 25 | 33.9 |
| | 11 | 100 | 38 | 50.4 | 1 | 25 | 24.9 |
| | 12 | 101 | 15 | 27.7 | 1 | 25 | 15.7 |
| | 13 | 101 | 52 | 05.9 | +1 | 25 | 06.3 |
| | 14 | 102 | 28 | 44.8 | 1 | 24 | 56.8 |
| | 15 | 103 | 05 | 24.5 | 1 | 24 | 47.1 |
| | 16 | 103 | 42 | 04.9 | 1 | 24 | 37.3 |
| | 17 | 104 | 18 | 45.9 | +1 | 24 | 27.3 |

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|
| | | ° | ′ | ″ | ° | ′ | ″ |
| May | 17 | 104 | 18 | 45.9 | +1 | 24 | 27.3 |
| | 18 | 104 | 55 | 27.6 | 1 | 24 | 17.2 |
| | 19 | 105 | 32 | 09.9 | 1 | 24 | 06.9 |
| | 20 | 106 | 08 | 52.7 | 1 | 23 | 56.4 |
| | 21 | 106 | 45 | 36.0 | 1 | 23 | 45.7 |
| | 22 | 107 | 22 | 19.9 | 1 | 23 | 34.9 |
| | 23 | 107 | 59 | 04.2 | +1 | 23 | 24.0 |
| | 24 | 108 | 35 | 49.0 | 1 | 23 | 12.8 |
| | 25 | 109 | 12 | 34.4 | 1 | 23 | 01.6 |
| | 26 | 109 | 49 | 20.3 | 1 | 22 | 50.1 |
| | 27 | 110 | 26 | 06.8 | 1 | 22 | 38.6 |
| | 28 | 111 | 02 | 54.0 | 1 | 22 | 26.8 |
| | 29 | 111 | 39 | 41.7 | +1 | 22 | 15.0 |
| | 30 | 112 | 16 | 30.0 | 1 | 22 | 03.0 |
| | 31 | 112 | 53 | 18.9 | 1 | 21 | 50.9 |
| June | 1 | 113 | 30 | 08.5 | 1 | 21 | 38.6 |
| | 2 | 114 | 06 | 58.7 | 1 | 21 | 26.3 |
| | 3 | 114 | 43 | 49.6 | 1 | 21 | 13.8 |
| | 4 | 115 | 20 | 41.2 | +1 | 21 | 01.1 |
| | 5 | 115 | 57 | 33.7 | 1 | 20 | 48.4 |
| | 6 | 116 | 34 | 26.9 | 1 | 20 | 35.6 |
| | 7 | 117 | 11 | 20.9 | 1 | 20 | 22.6 |
| | 8 | 117 | 48 | 15.7 | 1 | 20 | 09.5 |
| | 9 | 118 | 25 | 11.3 | 1 | 19 | 56.3 |
| | 10 | 119 | 02 | 07.8 | +1 | 19 | 42.9 |
| | 11 | 119 | 39 | 05.0 | 1 | 19 | 29.4 |
| | 12 | 120 | 16 | 02.9 | 1 | 19 | 15.8 |
| | 13 | 120 | 53 | 01.6 | 1 | 19 | 02.1 |
| | 14 | 121 | 30 | 00.9 | 1 | 18 | 48.3 |
| | 15 | 122 | 07 | 00.9 | 1 | 18 | 34.3 |
| | 16 | 122 | 44 | 01.5 | +1 | 18 | 20.2 |
| | 17 | 123 | 21 | 02.7 | 1 | 18 | 05.9 |
| | 18 | 123 | 58 | 04.5 | 1 | 17 | 51.5 |
| | 19 | 124 | 35 | 06.9 | 1 | 17 | 37.0 |
| | 20 | 125 | 12 | 09.8 | 1 | 17 | 22.4 |
| | 21 | 125 | 49 | 13.4 | 1 | 17 | 07.6 |
| | 22 | 126 | 26 | 17.6 | +1 | 16 | 52.7 |
| | 23 | 127 | 03 | 22.5 | 1 | 16 | 37.6 |
| | 24 | 127 | 40 | 28.1 | 1 | 16 | 22.5 |
| | 25 | 128 | 17 | 34.3 | 1 | 16 | 07.2 |
| | 26 | 128 | 54 | 41.2 | 1 | 15 | 51.9 |
| | 27 | 129 | 31 | 48.8 | 1 | 15 | 36.4 |
| | 28 | 130 | 08 | 57.1 | +1 | 15 | 20.8 |
| | 29 | 130 | 46 | 06.2 | 1 | 15 | 05.1 |
| | 30 | 131 | 23 | 16.0 | 1 | 14 | 49.3 |
| July | 1 | 132 | 00 | 26.7 | 1 | 14 | 33.4 |
| | 2 | 132 | 37 | 38.3 | +1 | 14 | 17.4 |

**MARS, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| July | 1 | 132 | 00 | 26.7 | +1 | 14 | 33.4 | Aug. | 16 | 160 | 48 | 28.9 | +1 | 00 | 22.8 |
| | 2 | 132 | 37 | 38.3 | 1 | 14 | 17.4 | | 17 | 161 | 26 | 30.0 | 1 | 00 | 01.7 |
| | 3 | 133 | 14 | 50.8 | 1 | 14 | 01.3 | | 18 | 162 | 04 | 32.3 | 0 | 59 | 40.5 |
| | 4 | 133 | 52 | 04.2 | 1 | 13 | 45.0 | | 19 | 162 | 42 | 35.8 | 0 | 59 | 19.2 |
| | 5 | 134 | 29 | 18.7 | 1 | 13 | 28.7 | | 20 | 163 | 20 | 40.6 | 0 | 58 | 57.8 |
| | 6 | 135 | 06 | 34.1 | 1 | 13 | 12.3 | | 21 | 163 | 58 | 46.7 | 0 | 58 | 36.3 |
| | 7 | 135 | 43 | 50.5 | +1 | 12 | 55.7 | | 22 | 164 | 36 | 54.0 | +0 | 58 | 14.7 |
| | 8 | 136 | 21 | 08.0 | 1 | 12 | 39.1 | | 23 | 165 | 15 | 02.6 | 0 | 57 | 52.9 |
| | 9 | 136 | 58 | 26.4 | 1 | 12 | 22.3 | | 24 | 165 | 53 | 12.6 | 0 | 57 | 31.1 |
| | 10 | 137 | 35 | 45.7 | 1 | 12 | 05.4 | | 25 | 166 | 31 | 24.0 | 0 | 57 | 09.2 |
| | 11 | 138 | 13 | 06.0 | 1 | 11 | 48.4 | | 26 | 167 | 09 | 36.9 | 0 | 56 | 47.2 |
| | 12 | 138 | 50 | 27.3 | 1 | 11 | 31.3 | | 27 | 167 | 47 | 51.4 | 0 | 56 | 25.0 |
| | 13 | 139 | 27 | 49.4 | +1 | 11 | 14.1 | | 28 | 168 | 26 | 07.4 | +0 | 56 | 02.8 |
| | 14 | 140 | 05 | 12.3 | 1 | 10 | 56.8 | | 29 | 169 | 04 | 25.0 | 0 | 55 | 40.5 |
| | 15 | 140 | 42 | 36.1 | 1 | 10 | 39.3 | | 30 | 169 | 42 | 44.3 | 0 | 55 | 18.0 |
| | 16 | 141 | 20 | 00.8 | 1 | 10 | 21.7 | | 31 | 170 | 21 | 05.2 | 0 | 54 | 55.5 |
| | 17 | 141 | 57 | 26.3 | 1 | 10 | 04.0 | Sept. | 1 | 170 | 59 | 27.8 | 0 | 54 | 32.8 |
| | 18 | 142 | 34 | 52.8 | 1 | 09 | 46.2 | | 2 | 171 | 37 | 52.1 | 0 | 54 | 10.0 |
| | 19 | 143 | 12 | 20.1 | +1 | 09 | 28.2 | | 3 | 172 | 16 | 18.0 | +0 | 53 | 47.1 |
| | 20 | 143 | 49 | 48.4 | 1 | 09 | 10.2 | | 4 | 172 | 54 | 45.5 | 0 | 53 | 24.0 |
| | 21 | 144 | 27 | 17.5 | 1 | 08 | 52.0 | | 5 | 173 | 33 | 14.7 | 0 | 53 | 00.9 |
| | 22 | 145 | 04 | 47.7 | 1 | 08 | 33.7 | | 6 | 174 | 11 | 45.5 | 0 | 52 | 37.6 |
| | 23 | 145 | 42 | 18.7 | 1 | 08 | 15.3 | | 7 | 174 | 50 | 17.9 | 0 | 52 | 14.2 |
| | 24 | 146 | 19 | 50.6 | 1 | 07 | 56.8 | | 8 | 175 | 28 | 52.0 | 0 | 51 | 50.7 |
| | 25 | 146 | 57 | 23.5 | +1 | 07 | 38.3 | | 9 | 176 | 07 | 27.6 | +0 | 51 | 27.0 |
| | 26 | 147 | 34 | 57.4 | 1 | 07 | 19.6 | | 10 | 176 | 46 | 04.8 | 0 | 51 | 03.2 |
| | 27 | 148 | 12 | 32.3 | 1 | 07 | 00.8 | | 11 | 177 | 24 | 43.7 | 0 | 50 | 39.3 |
| | 28 | 148 | 50 | 08.2 | 1 | 06 | 41.9 | | 12 | 178 | 03 | 24.3 | 0 | 50 | 15.3 |
| | 29 | 149 | 27 | 45.3 | 1 | 06 | 22.9 | | 13 | 178 | 42 | 06.4 | 0 | 49 | 51.2 |
| | 30 | 150 | 05 | 23.6 | 1 | 06 | 03.9 | | 14 | 179 | 20 | 50.2 | 0 | 49 | 26.9 |
| | 31 | 150 | 43 | 03.1 | +1 | 05 | 44.7 | | 15 | 179 | 59 | 35.6 | +0 | 49 | 02.5 |
| Aug. | 1 | 151 | 20 | 43.9 | 1 | 05 | 25.4 | | 16 | 180 | 38 | 22.6 | 0 | 48 | 38.1 |
| | 2 | 151 | 58 | 26.0 | 1 | 05 | 06.0 | | 17 | 181 | 17 | 11.1 | 0 | 48 | 13.5 |
| | 3 | 152 | 36 | 09.3 | 1 | 04 | 46.5 | | 18 | 181 | 56 | 01.3 | 0 | 47 | 48.8 |
| | 4 | 153 | 13 | 54.0 | 1 | 04 | 26.9 | | 19 | 182 | 34 | 53.0 | 0 | 47 | 24.0 |
| | 5 | 153 | 51 | 40.0 | 1 | 04 | 07.2 | | 20 | 183 | 13 | 46.4 | 0 | 46 | 59.0 |
| | 6 | 154 | 29 | 27.3 | +1 | 03 | 47.4 | | 21 | 183 | 52 | 41.6 | +0 | 46 | 34.0 |
| | 7 | 155 | 07 | 15.9 | 1 | 03 | 27.5 | | 22 | 184 | 31 | 38.4 | 0 | 46 | 08.9 |
| | 8 | 155 | 45 | 05.7 | 1 | 03 | 07.4 | | 23 | 185 | 10 | 37.2 | 0 | 45 | 43.6 |
| | 9 | 156 | 22 | 56.8 | 1 | 02 | 47.2 | | 24 | 185 | 49 | 37.7 | 0 | 45 | 18.2 |
| | 10 | 157 | 00 | 49.2 | 1 | 02 | 27.0 | | 25 | 186 | 28 | 40.2 | 0 | 44 | 52.8 |
| | 11 | 157 | 38 | 42.7 | 1 | 02 | 06.6 | | 26 | 187 | 07 | 44.7 | 0 | 44 | 27.1 |
| | 12 | 158 | 16 | 37.5 | +1 | 01 | 46.0 | | 27 | 187 | 46 | 51.1 | +0 | 44 | 01.4 |
| | 13 | 158 | 54 | 33.4 | 1 | 01 | 25.4 | | 28 | 188 | 25 | 59.5 | 0 | 43 | 35.6 |
| | 14 | 159 | 32 | 30.7 | 1 | 01 | 04.6 | | 29 | 189 | 05 | 09.9 | 0 | 43 | 09.6 |
| | 15 | 160 | 10 | 29.2 | 1 | 00 | 43.8 | | 30 | 189 | 44 | 22.2 | 0 | 42 | 43.5 |
| | 16 | 160 | 48 | 28.9 | +1 | 00 | 22.8 | Oct. | 1 | 190 | 23 | 36.6 | +0 | 42 | 17.2 |

**MARS, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| Oct. | 1 | 190 | 23 | 36.6 | +0 | 42 | 17.2 | Nov. | 16 | 221 | 05 | 18.4 | +0 | 19 | 45.1 |
| | 2 | 191 | 02 | 52.9 | 0 | 41 | 50.9 | | 17 | 221 | 46 | 11.0 | 0 | 19 | 12.4 |
| | 3 | 191 | 42 | 11.2 | 0 | 41 | 24.4 | | 18 | 222 | 27 | 05.9 | 0 | 18 | 39.7 |
| | 4 | 192 | 21 | 31.5 | 0 | 40 | 57.7 | | 19 | 223 | 08 | 03.1 | 0 | 18 | 06.7 |
| | 5 | 193 | 00 | 53.7 | 0 | 40 | 31.0 | | 20 | 223 | 49 | 02.6 | 0 | 17 | 33.6 |
| | 6 | 193 | 40 | 17.9 | 0 | 40 | 04.2 | | 21 | 224 | 30 | 04.5 | 0 | 17 | 00.4 |
| | 7 | 194 | 19 | 44.1 | +0 | 39 | 37.2 | | 22 | 225 | 11 | 08.7 | +0 | 16 | 27.0 |
| | 8 | 194 | 59 | 12.0 | 0 | 39 | 10.1 | | 23 | 225 | 52 | 15.3 | 0 | 15 | 53.4 |
| | 9 | 195 | 38 | 42.0 | 0 | 38 | 42.7 | | 24 | 226 | 33 | 24.3 | 0 | 15 | 19.7 |
| | 10 | 196 | 18 | 14.0 | 0 | 38 | 15.1 | | 25 | 227 | 14 | 35.6 | 0 | 14 | 45.9 |
| | 11 | 196 | 57 | 48.1 | 0 | 37 | 47.5 | | 26 | 227 | 55 | 49.4 | 0 | 14 | 11.8 |
| | 12 | 197 | 37 | 24.1 | 0 | 37 | 19.7 | | 27 | 228 | 37 | 05.5 | 0 | 13 | 37.7 |
| | 13 | 198 | 17 | 02.0 | +0 | 36 | 51.8 | | 28 | 229 | 18 | 24.0 | +0 | 13 | 03.3 |
| | 14 | 198 | 56 | 41.7 | 0 | 36 | 23.8 | | 29 | 229 | 59 | 44.9 | 0 | 12 | 28.8 |
| | 15 | 199 | 36 | 23.3 | 0 | 35 | 55.7 | | 30 | 230 | 41 | 08.2 | 0 | 11 | 54.1 |
| | 16 | 200 | 16 | 06.8 | 0 | 35 | 27.5 | Dec. | 1 | 231 | 22 | 33.9 | 0 | 11 | 19.3 |
| | 17 | 200 | 55 | 52.1 | 0 | 34 | 59.2 | | 2 | 232 | 04 | 02.1 | 0 | 10 | 44.3 |
| | 18 | 201 | 35 | 39.4 | 0 | 34 | 30.8 | | 3 | 232 | 45 | 32.6 | 0 | 10 | 09.1 |
| | 19 | 202 | 15 | 28.8 | +0 | 34 | 02.2 | | 4 | 233 | 27 | 05.6 | +0 | 09 | 33.8 |
| | 20 | 202 | 55 | 20.1 | 0 | 33 | 33.5 | | 5 | 234 | 08 | 40.9 | 0 | 08 | 58.3 |
| | 21 | 203 | 35 | 13.6 | 0 | 33 | 04.6 | | 6 | 234 | 50 | 18.6 | 0 | 08 | 22.7 |
| | 22 | 204 | 15 | 09.2 | 0 | 32 | 35.7 | | 7 | 235 | 31 | 58.4 | 0 | 07 | 47.0 |
| | 23 | 204 | 55 | 07.0 | 0 | 32 | 06.6 | | 8 | 236 | 13 | 40.4 | 0 | 07 | 11.1 |
| | 24 | 205 | 35 | 07.0 | 0 | 31 | 37.4 | | 9 | 236 | 55 | 24.5 | 0 | 06 | 35.0 |
| | 25 | 206 | 15 | 09.2 | +0 | 31 | 08.0 | | 10 | 237 | 37 | 10.8 | +0 | 05 | 58.8 |
| | 26 | 206 | 55 | 13.7 | 0 | 30 | 38.5 | | 11 | 238 | 18 | 59.2 | 0 | 05 | 22.5 |
| | 27 | 207 | 35 | 20.3 | 0 | 30 | 08.8 | | 12 | 239 | 00 | 49.8 | 0 | 04 | 46.1 |
| | 28 | 208 | 15 | 29.3 | 0 | 29 | 39.1 | | 13 | 239 | 42 | 42.6 | 0 | 04 | 09.5 |
| | 29 | 208 | 55 | 40.4 | 0 | 29 | 09.1 | | 14 | 240 | 24 | 37.7 | 0 | 03 | 32.7 |
| | 30 | 209 | 35 | 53.8 | 0 | 28 | 39.0 | | 15 | 241 | 06 | 35.1 | 0 | 02 | 55.8 |
| | 31 | 210 | 16 | 09.4 | +0 | 28 | 08.8 | | 16 | 241 | 48 | 34.8 | +0 | 02 | 18.8 |
| Nov. | 1 | 210 | 56 | 27.3 | 0 | 27 | 38.4 | | 17 | 242 | 30 | 36.9 | 0 | 01 | 41.6 |
| | 2 | 211 | 36 | 47.4 | 0 | 27 | 07.8 | | 18 | 243 | 12 | 41.3 | 0 | 01 | 04.2 |
| | 3 | 212 | 17 | 09.7 | 0 | 26 | 37.1 | | 19 | 243 | 54 | 48.1 | +0 | 00 | 26.8 |
| | 4 | 212 | 57 | 34.3 | 0 | 26 | 06.3 | | 20 | 244 | 36 | 57.3 | -0 | 00 | 10.9 |
| | 5 | 213 | 38 | 01.1 | 0 | 25 | 35.3 | | 21 | 245 | 19 | 08.8 | 0 | 00 | 48.7 |
| | 6 | 214 | 18 | 30.3 | +0 | 25 | 04.1 | | 22 | 246 | 01 | 22.8 | -0 | 01 | 26.7 |
| | 7 | 214 | 59 | 01.6 | 0 | 24 | 32.8 | | 23 | 246 | 43 | 39.1 | 0 | 02 | 04.8 |
| | 8 | 215 | 39 | 35.1 | 0 | 24 | 01.4 | | 24 | 247 | 25 | 57.8 | 0 | 02 | 43.1 |
| | 9 | 216 | 20 | 10.7 | 0 | 23 | 29.8 | | 25 | 248 | 08 | 19.0 | 0 | 03 | 21.6 |
| | 10 | 217 | 00 | 48.5 | 0 | 22 | 58.1 | | 26 | 248 | 50 | 42.5 | 0 | 04 | 00.2 |
| | 11 | 217 | 41 | 28.2 | 0 | 22 | 26.3 | | 27 | 249 | 33 | 08.4 | 0 | 04 | 38.9 |
| | 12 | 218 | 22 | 10.0 | +0 | 21 | 54.3 | | 28 | 250 | 15 | 36.8 | -0 | 05 | 17.9 |
| | 13 | 219 | 02 | 53.9 | 0 | 21 | 22.2 | | 29 | 250 | 58 | 07.6 | 0 | 05 | 57.0 |
| | 14 | 219 | 43 | 39.9 | 0 | 20 | 50.0 | | 30 | 251 | 40 | 40.9 | 0 | 06 | 36.2 |
| | 15 | 220 | 24 | 28.1 | 0 | 20 | 17.6 | | 31 | 252 | 23 | 16.7 | 0 | 07 | 15.6 |
| | 16 | 221 | 05 | 18.4 | +0 | 19 | 45.1 | | 32 | 253 | 05 | 54.8 | -0 | 07 | 55.2 |

**MARS, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Jan. | 0 | 1 | 38 | 41.85 | +11 | 10 | 15.9 | 0.889 496 | 9.89 | 5.26 | 18 | 57 | 20 |
| | 1 | 1 | 40 | 18.07 | 11 | 20 | 40.7 | 0.898 521 | 9.79 | 5.21 | 18 | 55 | 01 |
| | 2 | 1 | 41 | 55.53 | 11 | 31 | 08.1 | 0.907 582 | 9.69 | 5.16 | 18 | 52 | 43 |
| | 3 | 1 | 43 | 34.20 | 11 | 41 | 37.8 | 0.916 680 | 9.59 | 5.11 | 18 | 50 | 26 |
| | 4 | 1 | 45 | 14.07 | 11 | 52 | 09.8 | 0.925 814 | 9.50 | 5.06 | 18 | 48 | 11 |
| | 5 | 1 | 46 | 55.11 | 12 | 02 | 43.7 | 0.934 983 | 9.41 | 5.01 | 18 | 45 | 56 |
| | 6 | 1 | 48 | 37.31 | +12 | 13 | 19.4 | 0.944 186 | 9.31 | 4.96 | 18 | 43 | 43 |
| | 7 | 1 | 50 | 20.65 | 12 | 23 | 56.8 | 0.953 423 | 9.22 | 4.91 | 18 | 41 | 31 |
| | 8 | 1 | 52 | 05.12 | 12 | 34 | 35.6 | 0.962 692 | 9.13 | 4.86 | 18 | 39 | 20 |
| | 9 | 1 | 53 | 50.71 | 12 | 45 | 15.8 | 0.971 993 | 9.05 | 4.81 | 18 | 37 | 10 |
| | 10 | 1 | 55 | 37.39 | 12 | 55 | 57.1 | 0.981 324 | 8.96 | 4.77 | 18 | 35 | 01 |
| | 11 | 1 | 57 | 25.15 | 13 | 06 | 39.4 | 0.990 685 | 8.88 | 4.72 | 18 | 32 | 53 |
| | 12 | 1 | 59 | 13.98 | +13 | 17 | 22.5 | 1.000 074 | 8.79 | 4.68 | 18 | 30 | 47 |
| | 13 | 2 | 01 | 03.85 | 13 | 28 | 06.2 | 1.009 491 | 8.71 | 4.64 | 18 | 28 | 41 |
| | 14 | 2 | 02 | 54.75 | 13 | 38 | 50.4 | 1.018 933 | 8.63 | 4.59 | 18 | 26 | 36 |
| | 15 | 2 | 04 | 46.66 | 13 | 49 | 34.8 | 1.028 399 | 8.55 | 4.55 | 18 | 24 | 32 |
| | 16 | 2 | 06 | 39.56 | 14 | 00 | 19.3 | 1.037 889 | 8.47 | 4.51 | 18 | 22 | 30 |
| | 17 | 2 | 08 | 33.42 | 14 | 11 | 03.6 | 1.047 401 | 8.40 | 4.47 | 18 | 20 | 28 |
| | 18 | 2 | 10 | 28.25 | +14 | 21 | 47.5 | 1.056 934 | 8.32 | 4.43 | 18 | 18 | 27 |
| | 19 | 2 | 12 | 24.00 | 14 | 32 | 30.9 | 1.066 486 | 8.25 | 4.39 | 18 | 16 | 27 |
| | 20 | 2 | 14 | 20.68 | 14 | 43 | 13.5 | 1.076 058 | 8.17 | 4.35 | 18 | 14 | 28 |
| | 21 | 2 | 16 | 18.26 | 14 | 53 | 55.2 | 1.085 648 | 8.10 | 4.31 | 18 | 12 | 30 |
| | 22 | 2 | 18 | 16.73 | 15 | 04 | 35.8 | 1.095 254 | 8.03 | 4.27 | 18 | 10 | 33 |
| | 23 | 2 | 20 | 16.06 | 15 | 15 | 15.0 | 1.104 877 | 7.96 | 4.24 | 18 | 08 | 36 |
| | 24 | 2 | 22 | 16.25 | +15 | 25 | 52.7 | 1.114 516 | 7.89 | 4.20 | 18 | 06 | 41 |
| | 25 | 2 | 24 | 17.27 | 15 | 36 | 28.7 | 1.124 169 | 7.82 | 4.16 | 18 | 04 | 46 |
| | 26 | 2 | 26 | 19.12 | 15 | 47 | 02.9 | 1.133 836 | 7.76 | 4.13 | 18 | 02 | 52 |
| | 27 | 2 | 28 | 21.77 | 15 | 57 | 34.9 | 1.143 517 | 7.69 | 4.09 | 18 | 00 | 59 |
| | 28 | 2 | 30 | 25.20 | 16 | 08 | 04.7 | 1.153 211 | 7.63 | 4.06 | 17 | 59 | 06 |
| | 29 | 2 | 32 | 29.42 | 16 | 18 | 32.1 | 1.162 917 | 7.56 | 4.02 | 17 | 57 | 15 |
| | 30 | 2 | 34 | 34.40 | +16 | 28 | 56.8 | 1.172 635 | 7.50 | 3.99 | 17 | 55 | 24 |
| | 31 | 2 | 36 | 40.13 | 16 | 39 | 18.7 | 1.182 365 | 7.44 | 3.96 | 17 | 53 | 34 |
| Feb. | 1 | 2 | 38 | 46.60 | 16 | 49 | 37.7 | 1.192 106 | 7.38 | 3.93 | 17 | 51 | 44 |
| | 2 | 2 | 40 | 53.81 | 16 | 59 | 53.6 | 1.201 858 | 7.32 | 3.89 | 17 | 49 | 56 |
| | 3 | 2 | 43 | 01.75 | 17 | 10 | 06.3 | 1.211 620 | 7.26 | 3.86 | 17 | 48 | 08 |
| | 4 | 2 | 45 | 10.42 | 17 | 20 | 15.7 | 1.221 392 | 7.20 | 3.83 | 17 | 46 | 21 |
| | 5 | 2 | 47 | 19.82 | +17 | 30 | 21.5 | 1.231 173 | 7.14 | 3.80 | 17 | 44 | 34 |
| | 6 | 2 | 49 | 29.93 | 17 | 40 | 23.8 | 1.240 962 | 7.09 | 3.77 | 17 | 42 | 48 |
| | 7 | 2 | 51 | 40.75 | 17 | 50 | 22.4 | 1.250 759 | 7.03 | 3.74 | 17 | 41 | 03 |
| | 8 | 2 | 53 | 52.28 | 18 | 00 | 17.1 | 1.260 562 | 6.98 | 3.71 | 17 | 39 | 19 |
| | 9 | 2 | 56 | 04.50 | 18 | 10 | 07.9 | 1.270 371 | 6.92 | 3.68 | 17 | 37 | 35 |
| | 10 | 2 | 58 | 17.41 | 18 | 19 | 54.6 | 1.280 184 | 6.87 | 3.66 | 17 | 35 | 52 |
| | 11 | 3 | 00 | 31.00 | +18 | 29 | 37.0 | 1.290 001 | 6.82 | 3.63 | 17 | 34 | 10 |
| | 12 | 3 | 02 | 45.25 | 18 | 39 | 15.0 | 1.299 821 | 6.77 | 3.60 | 17 | 32 | 28 |
| | 13 | 3 | 05 | 00.17 | 18 | 48 | 48.4 | 1.309 641 | 6.71 | 3.57 | 17 | 30 | 47 |
| | 14 | 3 | 07 | 15.73 | 18 | 58 | 17.1 | 1.319 462 | 6.66 | 3.55 | 17 | 29 | 07 |
| | 15 | 3 | 09 | 31.94 | +19 | 07 | 41.0 | 1.329 283 | 6.62 | 3.52 | 17 | 27 | 27 |

**MARS, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Feb. | 15 | 3 | 09 | 31.94 | +19 | 07 | 41.0 | 1.329 283 | 6.62 | 3.52 | 17 | 27 | 27 |
| | 16 | 3 | 11 | 48.78 | 19 | 16 | 59.9 | 1.339 102 | 6.57 | 3.49 | 17 | 25 | 48 |
| | 17 | 3 | 14 | 06.24 | 19 | 26 | 13.6 | 1.348 919 | 6.52 | 3.47 | 17 | 24 | 09 |
| | 18 | 3 | 16 | 24.32 | 19 | 35 | 22.0 | 1.358 732 | 6.47 | 3.44 | 17 | 22 | 31 |
| | 19 | 3 | 18 | 43.00 | 19 | 44 | 25.0 | 1.368 542 | 6.43 | 3.42 | 17 | 20 | 54 |
| | 20 | 3 | 21 | 02.27 | 19 | 53 | 22.5 | 1.378 347 | 6.38 | 3.40 | 17 | 19 | 17 |
| | 21 | 3 | 23 | 22.12 | +20 | 02 | 14.2 | 1.388 147 | 6.34 | 3.37 | 17 | 17 | 41 |
| | 22 | 3 | 25 | 42.54 | 20 | 11 | 00.1 | 1.397 941 | 6.29 | 3.35 | 17 | 16 | 05 |
| | 23 | 3 | 28 | 03.53 | 20 | 19 | 40.0 | 1.407 728 | 6.25 | 3.32 | 17 | 14 | 30 |
| | 24 | 3 | 30 | 25.06 | 20 | 28 | 13.8 | 1.417 508 | 6.20 | 3.30 | 17 | 12 | 56 |
| | 25 | 3 | 32 | 47.13 | 20 | 36 | 41.4 | 1.427 281 | 6.16 | 3.28 | 17 | 11 | 22 |
| | 26 | 3 | 35 | 09.73 | 20 | 45 | 02.5 | 1.437 047 | 6.12 | 3.26 | 17 | 09 | 48 |
| | 27 | 3 | 37 | 32.84 | +20 | 53 | 17.1 | 1.446 804 | 6.08 | 3.23 | 17 | 08 | 15 |
| | 28 | 3 | 39 | 56.47 | 21 | 01 | 25.0 | 1.456 553 | 6.04 | 3.21 | 17 | 06 | 43 |
| Mar. | 1 | 3 | 42 | 20.60 | 21 | 09 | 26.1 | 1.466 293 | 6.00 | 3.19 | 17 | 05 | 11 |
| | 2 | 3 | 44 | 45.24 | 21 | 17 | 20.4 | 1.476 024 | 5.96 | 3.17 | 17 | 03 | 39 |
| | 3 | 3 | 47 | 10.37 | 21 | 25 | 07.6 | 1.485 747 | 5.92 | 3.15 | 17 | 02 | 08 |
| | 4 | 3 | 49 | 36.00 | 21 | 32 | 47.8 | 1.495 459 | 5.88 | 3.13 | 17 | 00 | 38 |
| | 5 | 3 | 52 | 02.12 | +21 | 40 | 20.8 | 1.505 162 | 5.84 | 3.11 | 16 | 59 | 08 |
| | 6 | 3 | 54 | 28.73 | 21 | 47 | 46.6 | 1.514 854 | 5.81 | 3.09 | 16 | 57 | 38 |
| | 7 | 3 | 56 | 55.83 | 21 | 55 | 05.0 | 1.524 534 | 5.77 | 3.07 | 16 | 56 | 09 |
| | 8 | 3 | 59 | 23.40 | 22 | 02 | 16.0 | 1.534 203 | 5.73 | 3.05 | 16 | 54 | 41 |
| | 9 | 4 | 01 | 51.44 | 22 | 09 | 19.5 | 1.543 859 | 5.70 | 3.03 | 16 | 53 | 13 |
| | 10 | 4 | 04 | 19.94 | 22 | 16 | 15.3 | 1.553 500 | 5.66 | 3.01 | 16 | 51 | 45 |
| | 11 | 4 | 06 | 48.89 | +22 | 23 | 03.5 | 1.563 127 | 5.63 | 2.99 | 16 | 50 | 18 |
| | 12 | 4 | 09 | 18.30 | 22 | 29 | 43.7 | 1.572 739 | 5.59 | 2.98 | 16 | 48 | 51 |
| | 13 | 4 | 11 | 48.14 | 22 | 36 | 16.1 | 1.582 334 | 5.56 | 2.96 | 16 | 47 | 25 |
| | 14 | 4 | 14 | 18.42 | 22 | 42 | 40.3 | 1.591 912 | 5.52 | 2.94 | 16 | 45 | 59 |
| | 15 | 4 | 16 | 49.12 | 22 | 48 | 56.5 | 1.601 471 | 5.49 | 2.92 | 16 | 44 | 33 |
| | 16 | 4 | 19 | 20.24 | 22 | 55 | 04.3 | 1.611 011 | 5.46 | 2.91 | 16 | 43 | 08 |
| | 17 | 4 | 21 | 51.77 | +23 | 01 | 03.9 | 1.620 532 | 5.43 | 2.89 | 16 | 41 | 44 |
| | 18 | 4 | 24 | 23.70 | 23 | 06 | 55.0 | 1.630 032 | 5.40 | 2.87 | 16 | 40 | 19 |
| | 19 | 4 | 26 | 56.02 | 23 | 12 | 37.6 | 1.639 511 | 5.36 | 2.85 | 16 | 38 | 56 |
| | 20 | 4 | 29 | 28.71 | 23 | 18 | 11.6 | 1.648 968 | 5.33 | 2.84 | 16 | 37 | 32 |
| | 21 | 4 | 32 | 01.77 | 23 | 23 | 36.9 | 1.658 402 | 5.30 | 2.82 | 16 | 36 | 09 |
| | 22 | 4 | 34 | 35.19 | 23 | 28 | 53.4 | 1.667 814 | 5.27 | 2.81 | 16 | 34 | 46 |
| | 23 | 4 | 37 | 08.96 | +23 | 34 | 01.1 | 1.677 202 | 5.24 | 2.79 | 16 | 33 | 24 |
| | 24 | 4 | 39 | 43.05 | 23 | 38 | 59.8 | 1.686 566 | 5.21 | 2.77 | 16 | 32 | 01 |
| | 25 | 4 | 42 | 17.47 | 23 | 43 | 49.4 | 1.695 907 | 5.19 | 2.76 | 16 | 30 | 40 |
| | 26 | 4 | 44 | 52.20 | 23 | 48 | 30.0 | 1.705 222 | 5.16 | 2.74 | 16 | 29 | 18 |
| | 27 | 4 | 47 | 27.23 | 23 | 53 | 01.3 | 1.714 513 | 5.13 | 2.73 | 16 | 27 | 57 |
| | 28 | 4 | 50 | 02.55 | 23 | 57 | 23.3 | 1.723 779 | 5.10 | 2.71 | 16 | 26 | 36 |
| | 29 | 4 | 52 | 38.15 | +24 | 01 | 35.9 | 1.733 020 | 5.07 | 2.70 | 16 | 25 | 15 |
| | 30 | 4 | 55 | 14.04 | 24 | 05 | 39.2 | 1.742 236 | 5.05 | 2.69 | 16 | 23 | 55 |
| | 31 | 4 | 57 | 50.20 | 24 | 09 | 32.9 | 1.751 427 | 5.02 | 2.67 | 16 | 22 | 35 |
| Apr. | 1 | 5 | 00 | 26.63 | 24 | 13 | 17.1 | 1.760 592 | 4.99 | 2.66 | 16 | 21 | 15 |
| | 2 | 5 | 03 | 03.33 | +24 | 16 | 51.8 | 1.769 732 | 4.97 | 2.64 | 16 | 19 | 55 |

**MARS, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Apr. | 1 | 5 | 00 | 26.63 | +24 | 13 | 17.1 | 1.760 592 | 4.99 | 2.66 | 16 | 21 | 15 |
| | 2 | 5 | 03 | 03.33 | 24 | 16 | 51.8 | 1.769 732 | 4.97 | 2.64 | 16 | 19 | 55 |
| | 3 | 5 | 05 | 40.29 | 24 | 20 | 16.9 | 1.778 845 | 4.94 | 2.63 | 16 | 18 | 36 |
| | 4 | 5 | 08 | 17.49 | 24 | 23 | 32.4 | 1.787 932 | 4.92 | 2.62 | 16 | 17 | 17 |
| | 5 | 5 | 10 | 54.94 | 24 | 26 | 38.1 | 1.796 991 | 4.89 | 2.60 | 16 | 15 | 58 |
| | 6 | 5 | 13 | 32.63 | 24 | 29 | 34.2 | 1.806 022 | 4.87 | 2.59 | 16 | 14 | 39 |
| | 7 | 5 | 16 | 10.54 | +24 | 32 | 20.4 | 1.815 024 | 4.85 | 2.58 | 16 | 13 | 21 |
| | 8 | 5 | 18 | 48.67 | 24 | 34 | 56.9 | 1.823 997 | 4.82 | 2.57 | 16 | 12 | 03 |
| | 9 | 5 | 21 | 27.02 | 24 | 37 | 23.4 | 1.832 940 | 4.80 | 2.55 | 16 | 10 | 45 |
| | 10 | 5 | 24 | 05.57 | 24 | 39 | 40.0 | 1.841 851 | 4.77 | 2.54 | 16 | 09 | 27 |
| | 11 | 5 | 26 | 44.31 | 24 | 41 | 46.6 | 1.850 730 | 4.75 | 2.53 | 16 | 08 | 09 |
| | 12 | 5 | 29 | 23.24 | 24 | 43 | 43.1 | 1.859 578 | 4.73 | 2.52 | 16 | 06 | 52 |
| | 13 | 5 | 32 | 02.35 | +24 | 45 | 29.6 | 1.868 391 | 4.71 | 2.50 | 16 | 05 | 34 |
| | 14 | 5 | 34 | 41.63 | 24 | 47 | 06.0 | 1.877 171 | 4.68 | 2.49 | 16 | 04 | 17 |
| | 15 | 5 | 37 | 21.07 | 24 | 48 | 32.3 | 1.885 916 | 4.66 | 2.48 | 16 | 03 | 00 |
| | 16 | 5 | 40 | 00.66 | 24 | 49 | 48.5 | 1.894 626 | 4.64 | 2.47 | 16 | 01 | 44 |
| | 17 | 5 | 42 | 40.38 | 24 | 50 | 54.4 | 1.903 301 | 4.62 | 2.46 | 16 | 00 | 27 |
| | 18 | 5 | 45 | 20.23 | 24 | 51 | 50.1 | 1.911 939 | 4.60 | 2.45 | 15 | 59 | 10 |
| | 19 | 5 | 48 | 00.20 | +24 | 52 | 35.7 | 1.920 540 | 4.58 | 2.44 | 15 | 57 | 54 |
| | 20 | 5 | 50 | 40.26 | 24 | 53 | 10.9 | 1.929 104 | 4.56 | 2.43 | 15 | 56 | 38 |
| | 21 | 5 | 53 | 20.41 | 24 | 53 | 35.9 | 1.937 631 | 4.54 | 2.42 | 15 | 55 | 21 |
| | 22 | 5 | 56 | 00.64 | 24 | 53 | 50.6 | 1.946 121 | 4.52 | 2.40 | 15 | 54 | 05 |
| | 23 | 5 | 58 | 40.94 | 24 | 53 | 54.9 | 1.954 572 | 4.50 | 2.39 | 15 | 52 | 49 |
| | 24 | 6 | 01 | 21.29 | 24 | 53 | 48.9 | 1.962 985 | 4.48 | 2.38 | 15 | 51 | 33 |
| | 25 | 6 | 04 | 01.68 | +24 | 53 | 32.6 | 1.971 360 | 4.46 | 2.37 | 15 | 50 | 17 |
| | 26 | 6 | 06 | 42.12 | 24 | 53 | 05.8 | 1.979 697 | 4.44 | 2.36 | 15 | 49 | 01 |
| | 27 | 6 | 09 | 22.59 | 24 | 52 | 28.7 | 1.987 995 | 4.42 | 2.35 | 15 | 47 | 45 |
| | 28 | 6 | 12 | 03.09 | 24 | 51 | 41.2 | 1.996 256 | 4.41 | 2.34 | 15 | 46 | 29 |
| | 29 | 6 | 14 | 43.62 | 24 | 50 | 43.4 | 2.004 478 | 4.39 | 2.33 | 15 | 45 | 13 |
| | 30 | 6 | 17 | 24.15 | 24 | 49 | 35.2 | 2.012 662 | 4.37 | 2.33 | 15 | 43 | 57 |
| May | 1 | 6 | 20 | 04.70 | +24 | 48 | 16.7 | 2.020 808 | 4.35 | 2.32 | 15 | 42 | 41 |
| | 2 | 6 | 22 | 45.25 | 24 | 46 | 47.9 | 2.028 914 | 4.33 | 2.31 | 15 | 41 | 25 |
| | 3 | 6 | 25 | 25.80 | 24 | 45 | 08.8 | 2.036 982 | 4.32 | 2.30 | 15 | 40 | 09 |
| | 4 | 6 | 28 | 06.33 | 24 | 43 | 19.4 | 2.045 009 | 4.30 | 2.29 | 15 | 38 | 53 |
| | 5 | 6 | 30 | 46.84 | 24 | 41 | 19.7 | 2.052 995 | 4.28 | 2.28 | 15 | 37 | 37 |
| | 6 | 6 | 33 | 27.33 | 24 | 39 | 09.7 | 2.060 940 | 4.27 | 2.27 | 15 | 36 | 21 |
| | 7 | 6 | 36 | 07.78 | +24 | 36 | 49.4 | 2.068 844 | 4.25 | 2.26 | 15 | 35 | 05 |
| | 8 | 6 | 38 | 48.19 | 24 | 34 | 18.8 | 2.076 705 | 4.23 | 2.25 | 15 | 33 | 49 |
| | 9 | 6 | 41 | 28.57 | 24 | 31 | 38.0 | 2.084 523 | 4.22 | 2.25 | 15 | 32 | 33 |
| | 10 | 6 | 44 | 08.89 | 24 | 28 | 46.9 | 2.092 297 | 4.20 | 2.24 | 15 | 31 | 16 |
| | 11 | 6 | 46 | 49.15 | 24 | 25 | 45.6 | 2.100 027 | 4.19 | 2.23 | 15 | 30 | 00 |
| | 12 | 6 | 49 | 29.34 | 24 | 22 | 34.1 | 2.107 711 | 4.17 | 2.22 | 15 | 28 | 44 |
| | 13 | 6 | 52 | 09.46 | +24 | 19 | 12.4 | 2.115 351 | 4.16 | 2.21 | 15 | 27 | 27 |
| | 14 | 6 | 54 | 49.50 | 24 | 15 | 40.6 | 2.122 944 | 4.14 | 2.20 | 15 | 26 | 11 |
| | 15 | 6 | 57 | 29.45 | 24 | 11 | 58.7 | 2.130 491 | 4.13 | 2.20 | 15 | 24 | 54 |
| | 16 | 7 | 00 | 09.29 | 24 | 08 | 06.7 | 2.137 991 | 4.11 | 2.19 | 15 | 23 | 38 |
| | 17 | 7 | 02 | 49.02 | +24 | 04 | 04.7 | 2.145 443 | 4.10 | 2.18 | 15 | 22 | 21 |

**MARS, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| May | 17 | 7 | 02 | 49.02 | +24 | 04 | 04.7 | 2.145 443 | 4.10 | 2.18 | 15 | 22 | 21 |
| | 18 | 7 | 05 | 28.63 | 23 | 59 | 52.7 | 2.152 848 | 4.08 | 2.17 | 15 | 21 | 04 |
| | 19 | 7 | 08 | 08.11 | 23 | 55 | 30.8 | 2.160 205 | 4.07 | 2.17 | 15 | 19 | 47 |
| | 20 | 7 | 10 | 47.44 | 23 | 50 | 58.9 | 2.167 514 | 4.06 | 2.16 | 15 | 18 | 29 |
| | 21 | 7 | 13 | 26.63 | 23 | 46 | 17.1 | 2.174 774 | 4.04 | 2.15 | 15 | 17 | 12 |
| | 22 | 7 | 16 | 05.67 | 23 | 41 | 25.5 | 2.181 986 | 4.03 | 2.14 | 15 | 15 | 55 |
| | 23 | 7 | 18 | 44.54 | +23 | 36 | 24.1 | 2.189 150 | 4.02 | 2.14 | 15 | 14 | 37 |
| | 24 | 7 | 21 | 23.25 | 23 | 31 | 12.9 | 2.196 265 | 4.00 | 2.13 | 15 | 13 | 19 |
| | 25 | 7 | 24 | 01.79 | 23 | 25 | 51.9 | 2.203 332 | 3.99 | 2.12 | 15 | 12 | 01 |
| | 26 | 7 | 26 | 40.16 | 23 | 20 | 21.3 | 2.210 351 | 3.98 | 2.12 | 15 | 10 | 43 |
| | 27 | 7 | 29 | 18.35 | 23 | 14 | 41.1 | 2.217 323 | 3.97 | 2.11 | 15 | 09 | 24 |
| | 28 | 7 | 31 | 56.37 | 23 | 08 | 51.3 | 2.224 246 | 3.95 | 2.10 | 15 | 08 | 06 |
| | 29 | 7 | 34 | 34.20 | +23 | 02 | 52.1 | 2.231 121 | 3.94 | 2.10 | 15 | 06 | 47 |
| | 30 | 7 | 37 | 11.84 | 22 | 56 | 43.4 | 2.237 947 | 3.93 | 2.09 | 15 | 05 | 28 |
| | 31 | 7 | 39 | 49.29 | 22 | 50 | 25.4 | 2.244 725 | 3.92 | 2.08 | 15 | 04 | 09 |
| June | 1 | 7 | 42 | 26.55 | 22 | 43 | 58.0 | 2.251 454 | 3.91 | 2.08 | 15 | 02 | 49 |
| | 2 | 7 | 45 | 03.61 | 22 | 37 | 21.3 | 2.258 134 | 3.89 | 2.07 | 15 | 01 | 30 |
| | 3 | 7 | 47 | 40.47 | 22 | 30 | 35.4 | 2.264 764 | 3.88 | 2.07 | 15 | 00 | 10 |
| | 4 | 7 | 50 | 17.13 | +22 | 23 | 40.3 | 2.271 343 | 3.87 | 2.06 | 14 | 58 | 50 |
| | 5 | 7 | 52 | 53.58 | 22 | 16 | 36.1 | 2.277 871 | 3.86 | 2.05 | 14 | 57 | 30 |
| | 6 | 7 | 55 | 29.83 | 22 | 09 | 22.7 | 2.284 347 | 3.85 | 2.05 | 14 | 56 | 10 |
| | 7 | 7 | 58 | 05.88 | 22 | 02 | 00.4 | 2.290 771 | 3.84 | 2.04 | 14 | 54 | 49 |
| | 8 | 8 | 00 | 41.72 | 21 | 54 | 29.0 | 2.297 143 | 3.83 | 2.04 | 14 | 53 | 28 |
| | 9 | 8 | 03 | 17.34 | 21 | 46 | 48.8 | 2.303 461 | 3.82 | 2.03 | 14 | 52 | 07 |
| | 10 | 8 | 05 | 52.74 | +21 | 38 | 59.8 | 2.309 726 | 3.81 | 2.03 | 14 | 50 | 46 |
| | 11 | 8 | 08 | 27.93 | 21 | 31 | 01.9 | 2.315 937 | 3.80 | 2.02 | 14 | 49 | 25 |
| | 12 | 8 | 11 | 02.89 | 21 | 22 | 55.4 | 2.322 093 | 3.79 | 2.02 | 14 | 48 | 03 |
| | 13 | 8 | 13 | 37.61 | 21 | 14 | 40.4 | 2.328 194 | 3.78 | 2.01 | 14 | 46 | 41 |
| | 14 | 8 | 16 | 12.10 | 21 | 06 | 16.7 | 2.334 240 | 3.77 | 2.00 | 14 | 45 | 19 |
| | 15 | 8 | 18 | 46.35 | 20 | 57 | 44.6 | 2.340 231 | 3.76 | 2.00 | 14 | 43 | 57 |
| | 16 | 8 | 21 | 20.35 | +20 | 49 | 04.1 | 2.346 166 | 3.75 | 1.99 | 14 | 42 | 34 |
| | 17 | 8 | 23 | 54.11 | 20 | 40 | 15.3 | 2.352 045 | 3.74 | 1.99 | 14 | 41 | 11 |
| | 18 | 8 | 26 | 27.61 | 20 | 31 | 18.3 | 2.357 868 | 3.73 | 1.98 | 14 | 39 | 48 |
| | 19 | 8 | 29 | 00.86 | 20 | 22 | 13.1 | 2.363 634 | 3.72 | 1.98 | 14 | 38 | 25 |
| | 20 | 8 | 31 | 33.85 | 20 | 12 | 59.7 | 2.369 345 | 3.71 | 1.98 | 14 | 37 | 01 |
| | 21 | 8 | 34 | 06.59 | 20 | 03 | 38.3 | 2.375 001 | 3.70 | 1.97 | 14 | 35 | 37 |
| | 22 | 8 | 36 | 39.08 | +19 | 54 | 09.0 | 2.380 600 | 3.69 | 1.97 | 14 | 34 | 13 |
| | 23 | 8 | 39 | 11.31 | 19 | 44 | 31.7 | 2.386 144 | 3.69 | 1.96 | 14 | 32 | 48 |
| | 24 | 8 | 41 | 43.29 | 19 | 34 | 46.7 | 2.391 633 | 3.68 | 1.96 | 14 | 31 | 24 |
| | 25 | 8 | 44 | 15.02 | 19 | 24 | 54.0 | 2.397 066 | 3.67 | 1.95 | 14 | 29 | 59 |
| | 26 | 8 | 46 | 46.49 | 19 | 14 | 53.7 | 2.402 445 | 3.66 | 1.95 | 14 | 28 | 34 |
| | 27 | 8 | 49 | 17.70 | 19 | 04 | 45.9 | 2.407 768 | 3.65 | 1.94 | 14 | 27 | 08 |
| | 28 | 8 | 51 | 48.67 | +18 | 54 | 30.6 | 2.413 036 | 3.64 | 1.94 | 14 | 25 | 43 |
| | 29 | 8 | 54 | 19.38 | 18 | 44 | 07.8 | 2.418 248 | 3.64 | 1.94 | 14 | 24 | 17 |
| | 30 | 8 | 56 | 49.84 | 18 | 33 | 37.8 | 2.423 404 | 3.63 | 1.93 | 14 | 22 | 51 |
| July | 1 | 8 | 59 | 20.06 | 18 | 23 | 00.4 | 2.428 504 | 3.62 | 1.93 | 14 | 21 | 24 |
| | 2 | 9 | 01 | 50.04 | +18 | 12 | 15.9 | 2.433 548 | 3.61 | 1.92 | 14 | 19 | 58 |

**MARS, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| July | 1 | 8 | 59 | 20.06 | +18 | 23 | 00.4 | 2.428 504 | 3.62 | 1.93 | 14 | 21 | 24 |
| | 2 | 9 | 01 | 50.04 | 18 | 12 | 15.9 | 2.433 548 | 3.61 | 1.92 | 14 | 19 | 58 |
| | 3 | 9 | 04 | 19.78 | 18 | 01 | 24.1 | 2.438 534 | 3.61 | 1.92 | 14 | 18 | 31 |
| | 4 | 9 | 06 | 49.28 | 17 | 50 | 25.3 | 2.443 462 | 3.60 | 1.92 | 14 | 17 | 04 |
| | 5 | 9 | 09 | 18.55 | 17 | 39 | 19.6 | 2.448 333 | 3.59 | 1.91 | 14 | 15 | 36 |
| | 6 | 9 | 11 | 47.59 | 17 | 28 | 06.9 | 2.453 145 | 3.58 | 1.91 | 14 | 14 | 09 |
| | 7 | 9 | 14 | 16.39 | +17 | 16 | 47.3 | 2.457 898 | 3.58 | 1.90 | 14 | 12 | 41 |
| | 8 | 9 | 16 | 44.97 | 17 | 05 | 21.0 | 2.462 592 | 3.57 | 1.90 | 14 | 11 | 13 |
| | 9 | 9 | 19 | 13.31 | 16 | 53 | 48.1 | 2.467 226 | 3.56 | 1.90 | 14 | 09 | 45 |
| | 10 | 9 | 21 | 41.42 | 16 | 42 | 08.6 | 2.471 799 | 3.56 | 1.89 | 14 | 08 | 16 |
| | 11 | 9 | 24 | 9.30 | 16 | 30 | 22.6 | 2.476 313 | 3.55 | 1.89 | 14 | 06 | 47 |
| | 12 | 9 | 26 | 36.95 | 16 | 18 | 30.2 | 2.480 765 | 3.54 | 1.89 | 14 | 05 | 18 |
| | 13 | 9 | 29 | 4.37 | +16 | 06 | 31.5 | 2.485 157 | 3.54 | 1.88 | 14 | 03 | 49 |
| | 14 | 9 | 31 | 31.55 | 15 | 54 | 26.6 | 2.489 487 | 3.53 | 1.88 | 14 | 02 | 20 |
| | 15 | 9 | 33 | 58.51 | 15 | 42 | 15.6 | 2.493 756 | 3.53 | 1.88 | 14 | 00 | 50 |
| | 16 | 9 | 36 | 25.23 | 15 | 29 | 58.5 | 2.497 964 | 3.52 | 1.87 | 13 | 59 | 20 |
| | 17 | 9 | 38 | 51.73 | 15 | 17 | 35.4 | 2.502 110 | 3.51 | 1.87 | 13 | 57 | 50 |
| | 18 | 9 | 41 | 18.00 | 15 | 05 | 06.5 | 2.506 195 | 3.51 | 1.87 | 13 | 56 | 20 |
| | 19 | 9 | 43 | 44.06 | +14 | 52 | 31.7 | 2.510 219 | 3.50 | 1.86 | 13 | 54 | 49 |
| | 20 | 9 | 46 | 9.90 | 14 | 39 | 51.2 | 2.514 183 | 3.50 | 1.86 | 13 | 53 | 19 |
| | 21 | 9 | 48 | 35.53 | 14 | 27 | 05.1 | 2.518 085 | 3.49 | 1.86 | 13 | 51 | 48 |
| | 22 | 9 | 51 | 0.95 | 14 | 14 | 13.5 | 2.521 928 | 3.49 | 1.86 | 13 | 50 | 17 |
| | 23 | 9 | 53 | 26.16 | 14 | 01 | 16.5 | 2.525 710 | 3.48 | 1.85 | 13 | 48 | 45 |
| | 24 | 9 | 55 | 51.17 | 13 | 48 | 14.1 | 2.529 432 | 3.48 | 1.85 | 13 | 47 | 14 |
| | 25 | 9 | 58 | 15.97 | +13 | 35 | 06.5 | 2.533 095 | 3.47 | 1.85 | 13 | 45 | 42 |
| | 26 | 10 | 00 | 40.58 | 13 | 21 | 53.6 | 2.536 698 | 3.47 | 1.84 | 13 | 44 | 10 |
| | 27 | 10 | 03 | 5.00 | 13 | 08 | 35.7 | 2.540 240 | 3.46 | 1.84 | 13 | 42 | 38 |
| | 28 | 10 | 05 | 29.24 | 12 | 55 | 12.7 | 2.543 723 | 3.46 | 1.84 | 13 | 41 | 05 |
| | 29 | 10 | 07 | 53.30 | 12 | 41 | 44.7 | 2.547 145 | 3.45 | 1.84 | 13 | 39 | 33 |
| | 30 | 10 | 10 | 17.19 | 12 | 28 | 11.8 | 2.550 506 | 3.45 | 1.83 | 13 | 38 | 00 |
| | 31 | 10 | 12 | 40.92 | +12 | 14 | 34.0 | 2.553 807 | 3.44 | 1.83 | 13 | 36 | 27 |
| Aug. | 1 | 10 | 15 | 4.49 | 12 | 00 | 51.4 | 2.557 045 | 3.44 | 1.83 | 13 | 34 | 54 |
| | 2 | 10 | 17 | 27.91 | 11 | 47 | 04.2 | 2.560 223 | 3.43 | 1.83 | 13 | 33 | 21 |
| | 3 | 10 | 19 | 51.18 | 11 | 33 | 12.3 | 2.563 337 | 3.43 | 1.83 | 13 | 31 | 48 |
| | 4 | 10 | 22 | 14.30 | 11 | 19 | 15.9 | 2.566 390 | 3.43 | 1.82 | 13 | 30 | 15 |
| | 5 | 10 | 24 | 37.29 | 11 | 05 | 15.1 | 2.569 380 | 3.42 | 1.82 | 13 | 28 | 41 |
| | 6 | 10 | 27 | 0.13 | +10 | 51 | 10.0 | 2.572 306 | 3.42 | 1.82 | 13 | 27 | 07 |
| | 7 | 10 | 29 | 22.85 | 10 | 37 | 00.6 | 2.575 169 | 3.41 | 1.82 | 13 | 25 | 34 |
| | 8 | 10 | 31 | 45.43 | 10 | 22 | 47.0 | 2.577 968 | 3.41 | 1.82 | 13 | 23 | 60 |
| | 9 | 10 | 34 | 7.88 | 10 | 08 | 29.3 | 2.580 703 | 3.41 | 1.81 | 13 | 22 | 26 |
| | 10 | 10 | 36 | 30.21 | 9 | 54 | 07.7 | 2.583 374 | 3.40 | 1.81 | 13 | 20 | 51 |
| | 11 | 10 | 38 | 52.41 | 9 | 39 | 42.2 | 2.585 980 | 3.40 | 1.81 | 13 | 19 | 17 |
| | 12 | 10 | 41 | 14.50 | +9 | 25 | 12.9 | 2.588 522 | 3.40 | 1.81 | 13 | 17 | 43 |
| | 13 | 10 | 43 | 36.47 | 9 | 10 | 39.9 | 2.590 999 | 3.39 | 1.81 | 13 | 16 | 08 |
| | 14 | 10 | 45 | 58.33 | 8 | 56 | 03.2 | 2.593 412 | 3.39 | 1.80 | 13 | 14 | 33 |
| | 15 | 10 | 48 | 20.10 | 8 | 41 | 23.0 | 2.595 761 | 3.39 | 1.80 | 13 | 12 | 59 |
| | 16 | 10 | 50 | 41.76 | +8 | 26 | 39.4 | 2.598 045 | 3.38 | 1.80 | 13 | 11 | 24 |

**MARS, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Aug. | 16 | 10 | 50 | 41.76 | +8 | 26 | 39.4 | 2.598 045 | 3.38 | 1.80 | 13 | 11 | 24 |
| | 17 | 10 | 53 | 3.33 | 8 | 11 | 52.4 | 2.600 266 | 3.38 | 1.80 | 13 | 09 | 49 |
| | 18 | 10 | 55 | 24.82 | 7 | 57 | 2.1 | 2.602 424 | 3.38 | 1.80 | 13 | 08 | 14 |
| | 19 | 10 | 57 | 46.22 | 7 | 42 | 8.7 | 2.604 518 | 3.38 | 1.80 | 13 | 06 | 39 |
| | 20 | 11 | 00 | 7.54 | 7 | 27 | 12.2 | 2.606 550 | 3.37 | 1.80 | 13 | 05 | 04 |
| | 21 | 11 | 02 | 28.79 | 7 | 12 | 12.8 | 2.608 519 | 3.37 | 1.79 | 13 | 03 | 28 |
| | 22 | 11 | 04 | 49.97 | +6 | 57 | 10.4 | 2.610 426 | 3.37 | 1.79 | 13 | 01 | 53 |
| | 23 | 11 | 07 | 11.09 | 6 | 42 | 5.3 | 2.612 271 | 3.37 | 1.79 | 13 | 00 | 18 |
| | 24 | 11 | 09 | 32.16 | 6 | 26 | 57.3 | 2.614 053 | 3.36 | 1.79 | 12 | 58 | 42 |
| | 25 | 11 | 11 | 53.18 | 6 | 11 | 46.7 | 2.615 773 | 3.36 | 1.79 | 12 | 57 | 07 |
| | 26 | 11 | 14 | 14.17 | 5 | 56 | 33.5 | 2.617 431 | 3.36 | 1.79 | 12 | 55 | 31 |
| | 27 | 11 | 16 | 35.13 | 5 | 41 | 17.8 | 2.619 027 | 3.36 | 1.79 | 12 | 53 | 56 |
| | 28 | 11 | 18 | 56.07 | +5 | 25 | 59.5 | 2.620 559 | 3.36 | 1.79 | 12 | 52 | 20 |
| | 29 | 11 | 21 | 17.01 | 5 | 10 | 38.9 | 2.622 029 | 3.35 | 1.78 | 12 | 50 | 45 |
| | 30 | 11 | 23 | 37.93 | 4 | 55 | 15.9 | 2.623 436 | 3.35 | 1.78 | 12 | 49 | 09 |
| | 31 | 11 | 25 | 58.86 | 4 | 39 | 50.8 | 2.624 779 | 3.35 | 1.78 | 12 | 47 | 34 |
| Sept. | 1 | 11 | 28 | 19.80 | 4 | 24 | 23.5 | 2.626 058 | 3.35 | 1.78 | 12 | 45 | 58 |
| | 2 | 11 | 30 | 40.75 | 4 | 08 | 54.1 | 2.627 274 | 3.35 | 1.78 | 12 | 44 | 23 |
| | 3 | 11 | 33 | 1.71 | +3 | 53 | 22.8 | 2.628 425 | 3.35 | 1.78 | 12 | 42 | 47 |
| | 4 | 11 | 35 | 22.70 | 3 | 37 | 49.6 | 2.629 512 | 3.34 | 1.78 | 12 | 41 | 12 |
| | 5 | 11 | 37 | 43.71 | 3 | 22 | 14.7 | 2.630 534 | 3.34 | 1.78 | 12 | 39 | 37 |
| | 6 | 11 | 40 | 4.76 | 3 | 06 | 38.1 | 2.631 491 | 3.34 | 1.78 | 12 | 38 | 01 |
| | 7 | 11 | 42 | 25.84 | 2 | 50 | 59.9 | 2.632 383 | 3.34 | 1.78 | 12 | 36 | 26 |
| | 8 | 11 | 44 | 46.97 | 2 | 35 | 20.3 | 2.633 210 | 3.34 | 1.78 | 12 | 34 | 51 |
| | 9 | 11 | 47 | 8.14 | +2 | 19 | 39.2 | 2.633 972 | 3.34 | 1.78 | 12 | 33 | 15 |
| | 10 | 11 | 49 | 29.37 | 2 | 03 | 56.9 | 2.634 668 | 3.34 | 1.78 | 12 | 31 | 40 |
| | 11 | 11 | 51 | 50.66 | 1 | 48 | 13.4 | 2.635 299 | 3.34 | 1.78 | 12 | 30 | 05 |
| | 12 | 11 | 54 | 12.02 | 1 | 32 | 28.8 | 2.635 865 | 3.34 | 1.78 | 12 | 28 | 30 |
| | 13 | 11 | 56 | 33.45 | 1 | 16 | 43.2 | 2.636 367 | 3.34 | 1.78 | 12 | 26 | 55 |
| | 14 | 11 | 58 | 54.95 | 1 | 00 | 56.7 | 2.636 805 | 3.34 | 1.77 | 12 | 25 | 20 |
| | 15 | 12 | 01 | 16.54 | +0 | 45 | 9.4 | 2.637 179 | 3.33 | 1.77 | 12 | 23 | 45 |
| | 16 | 12 | 03 | 38.22 | 0 | 29 | 21.5 | 2.637 490 | 3.33 | 1.77 | 12 | 22 | 10 |
| | 17 | 12 | 05 | 59.99 | 0 | 13 | 32.9 | 2.637 738 | 3.33 | 1.77 | 12 | 20 | 36 |
| | 18 | 12 | 08 | 21.85 | 0 | 02 | 16.1 | 2.637 923 | 3.33 | 1.77 | 12 | 19 | 01 |
| | 19 | 12 | 10 | 43.83 | 0 | 18 | 5.5 | 2.638 046 | 3.33 | 1.77 | 12 | 17 | 27 |
| | 20 | 12 | 13 | 5.92 | 0 | 33 | 55.2 | 2.638 107 | 3.33 | 1.77 | 12 | 15 | 53 |
| | 21 | 12 | 15 | 28.13 | +0 | 49 | 45.2 | 2.638 107 | 3.33 | 1.77 | 12 | 14 | 18 |
| | 22 | 12 | 17 | 50.48 | -1 | 05 | 35.3 | 2.638 045 | 3.33 | 1.77 | 12 | 12 | 44 |
| | 23 | 12 | 20 | 12.97 | 1 | 21 | 25.5 | 2.637 921 | 3.33 | 1.77 | 12 | 11 | 11 |
| | 24 | 12 | 22 | 35.62 | 1 | 37 | 15.7 | 2.637 735 | 3.33 | 1.77 | 12 | 09 | 37 |
| | 25 | 12 | 24 | 58.43 | 1 | 53 | 5.8 | 2.637 488 | 3.33 | 1.77 | 12 | 08 | 03 |
| | 26 | 12 | 27 | 21.40 | 2 | 08 | 55.8 | 2.637 179 | 3.33 | 1.77 | 12 | 06 | 30 |
| | 27 | 12 | 29 | 44.55 | -2 | 24 | 45.5 | 2.636 809 | 3.34 | 1.77 | 12 | 04 | 57 |
| | 28 | 12 | 32 | 7.89 | 2 | 40 | 34.8 | 2.636 376 | 3.34 | 1.78 | 12 | 03 | 24 |
| | 29 | 12 | 34 | 31.41 | 2 | 56 | 23.7 | 2.635 881 | 3.34 | 1.78 | 12 | 01 | 51 |
| | 30 | 12 | 36 | 55.13 | 3 | 12 | 12.0 | 2.635 324 | 3.34 | 1.78 | 12 | 00 | 18 |
| Oct. | 1 | 12 | 39 | 19.06 | -3 | 27 | 59.7 | 2.634 705 | 3.34 | 1.78 | 11 | 58 | 46 |

**MARS, 2021**
RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Oct. | 1 | 12 | 39 | 19.06 | -3 | 27 | 59.7 | 2.634 705 | 3.34 | 1.78 | 11 | 58 | 46 |
| | 2 | 12 | 41 | 43.19 | 3 | 43 | 46.6 | 2.634 023 | 3.34 | 1.78 | 11 | 57 | 14 |
| | 3 | 12 | 44 | 07.53 | 3 | 59 | 32.6 | 2.633 278 | 3.34 | 1.78 | 11 | 55 | 42 |
| | 4 | 12 | 46 | 32.09 | 4 | 15 | 17.6 | 2.632 470 | 3.34 | 1.78 | 11 | 54 | 10 |
| | 5 | 12 | 48 | 56.88 | 4 | 31 | 01.5 | 2.631 600 | 3.34 | 1.78 | 11 | 52 | 38 |
| | 6 | 12 | 51 | 21.89 | 4 | 46 | 44.2 | 2.630 666 | 3.34 | 1.78 | 11 | 51 | 07 |
| | 7 | 12 | 53 | 47.15 | -5 | 02 | 25.5 | 2.629 669 | 3.34 | 1.78 | 11 | 49 | 36 |
| | 8 | 12 | 56 | 12.64 | 5 | 18 | 05.3 | 2.628 610 | 3.35 | 1.78 | 11 | 48 | 05 |
| | 9 | 12 | 58 | 38.37 | 5 | 33 | 43.8 | 2.627 487 | 3.35 | 1.78 | 11 | 46 | 34 |
| | 10 | 13 | 01 | 04.37 | 5 | 49 | 20.8 | 2.626 302 | 3.35 | 1.78 | 11 | 45 | 04 |
| | 11 | 13 | 03 | 30.64 | 6 | 04 | 55.9 | 2.625 056 | 3.35 | 1.78 | 11 | 43 | 34 |
| | 12 | 13 | 05 | 57.17 | 6 | 20 | 29.2 | 2.623 748 | 3.35 | 1.78 | 11 | 42 | 04 |
| | 13 | 13 | 08 | 23.97 | -6 | 36 | 00.4 | 2.622 379 | 3.35 | 1.78 | 11 | 40 | 35 |
| | 14 | 13 | 10 | 51.04 | 6 | 51 | 29.5 | 2.620 949 | 3.36 | 1.79 | 11 | 39 | 05 |
| | 15 | 13 | 13 | 18.40 | 7 | 06 | 56.4 | 2.619 460 | 3.36 | 1.79 | 11 | 37 | 36 |
| | 16 | 13 | 15 | 46.04 | 7 | 22 | 20.8 | 2.617 911 | 3.36 | 1.79 | 11 | 36 | 08 |
| | 17 | 13 | 18 | 13.97 | 7 | 37 | 42.8 | 2.616 304 | 3.36 | 1.79 | 11 | 34 | 39 |
| | 18 | 13 | 20 | 42.21 | 7 | 53 | 02.3 | 2.614 638 | 3.36 | 1.79 | 11 | 33 | 11 |
| | 19 | 13 | 23 | 10.76 | -8 | 08 | 19.0 | 2.612 914 | 3.37 | 1.79 | 11 | 31 | 43 |
| | 20 | 13 | 25 | 39.63 | 8 | 23 | 33.0 | 2.611 132 | 3.37 | 1.79 | 11 | 30 | 16 |
| | 21 | 13 | 28 | 08.83 | 8 | 38 | 44.2 | 2.609 292 | 3.37 | 1.79 | 11 | 28 | 49 |
| | 22 | 13 | 30 | 38.37 | 8 | 53 | 52.4 | 2.607 395 | 3.37 | 1.79 | 11 | 27 | 22 |
| | 23 | 13 | 33 | 08.25 | 9 | 08 | 57.5 | 2.605 440 | 3.38 | 1.80 | 11 | 25 | 56 |
| | 24 | 13 | 35 | 38.49 | -9 | 23 | 59.5 | 2.603 428 | 3.38 | 1.80 | 11 | 24 | 30 |
| | 25 | 13 | 38 | 09.09 | -9 | 38 | 58.2 | 2.601 359 | 3.38 | 1.80 | 11 | 23 | 04 |
| | 26 | 13 | 40 | 40.06 | 9 | 53 | 53.5 | 2.599 233 | 3.38 | 1.80 | 11 | 21 | 39 |
| | 27 | 13 | 43 | 11.40 | 10 | 08 | 45.3 | 2.597 050 | 3.39 | 1.80 | 11 | 20 | 14 |
| | 28 | 13 | 45 | 43.12 | 10 | 23 | 33.5 | 2.594 810 | 3.39 | 1.80 | 11 | 18 | 49 |
| | 29 | 13 | 48 | 15.22 | 10 | 38 | 17.9 | 2.592 512 | 3.39 | 1.81 | 11 | 17 | 25 |
| | 30 | 13 | 50 | 47.71 | 10 | 52 | 58.5 | 2.590 158 | 3.40 | 1.81 | 11 | 16 | 01 |
| | 31 | 13 | 53 | 20.59 | -11 | 07 | 35.0 | 2.587 746 | 3.40 | 1.81 | 11 | 14 | 38 |
| Nov. | 1 | 13 | 55 | 53.88 | 11 | 22 | 07.4 | 2.585 277 | 3.40 | 1.81 | 11 | 13 | 15 |
| | 2 | 13 | 58 | 27.57 | 11 | 36 | 35.5 | 2.582 751 | 3.40 | 1.81 | 11 | 11 | 52 |
| | 3 | 14 | 01 | 01.67 | 11 | 50 | 59.3 | 2.580 168 | 3.41 | 1.81 | 11 | 10 | 30 |
| | 4 | 14 | 03 | 36.18 | 12 | 05 | 18.5 | 2.577 527 | 3.41 | 1.82 | 11 | 09 | 08 |
| | 5 | 14 | 06 | 11.12 | 12 | 19 | 33.1 | 2.574 830 | 3.42 | 1.82 | 11 | 07 | 47 |
| | 6 | 14 | 08 | 46.49 | -12 | 33 | 42.9 | 2.572 075 | 3.42 | 1.82 | 11 | 06 | 26 |
| | 7 | 14 | 11 | 22.29 | 12 | 47 | 47.8 | 2.569 265 | 3.42 | 1.82 | 11 | 05 | 05 |
| | 8 | 14 | 13 | 58.52 | 13 | 01 | 47.6 | 2.566 399 | 3.43 | 1.82 | 11 | 03 | 45 |
| | 9 | 14 | 16 | 35.18 | 13 | 15 | 42.2 | 2.563 477 | 3.43 | 1.83 | 11 | 02 | 26 |
| | 10 | 14 | 19 | 12.27 | 13 | 29 | 31.5 | 2.560 501 | 3.43 | 1.83 | 11 | 01 | 07 |
| | 11 | 14 | 21 | 49.80 | 13 | 43 | 15.3 | 2.557 472 | 3.44 | 1.83 | 10 | 59 | 48 |
| | 12 | 14 | 24 | 27.78 | -13 | 56 | 53.5 | 2.554 389 | 3.44 | 1.83 | 10 | 58 | 30 |
| | 13 | 14 | 27 | 06.20 | 14 | 10 | 25.8 | 2.551 254 | 3.45 | 1.83 | 10 | 57 | 12 |
| | 14 | 14 | 29 | 45.07 | 14 | 23 | 52.3 | 2.548 067 | 3.45 | 1.84 | 10 | 55 | 54 |
| | 15 | 14 | 32 | 24.40 | 14 | 37 | 12.8 | 2.544 829 | 3.46 | 1.84 | 10 | 54 | 37 |
| | 16 | 14 | 35 | 04.20 | -14 | 50 | 27.1 | 2.541 540 | 3.46 | 1.84 | 10 | 53 | 21 |

**MARS, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Nov. | 16 | 14 | 35 | 04.20 | -14 | 50 | 27.1 | 2.541 540 | 3.46 | 1.84 | 10 | 53 | 21 |
| | 17 | 14 | 37 | 44.48 | 15 | 03 | 35.2 | 2.538 201 | 3.46 | 1.84 | 10 | 52 | 05 |
| | 18 | 14 | 40 | 25.23 | 15 | 16 | 36.9 | 2.534 812 | 3.47 | 1.85 | 10 | 50 | 49 |
| | 19 | 14 | 43 | 06.47 | 15 | 29 | 32.0 | 2.531 373 | 3.47 | 1.85 | 10 | 49 | 34 |
| | 20 | 14 | 45 | 48.19 | 15 | 42 | 20.6 | 2.527 885 | 3.48 | 1.85 | 10 | 48 | 20 |
| | 21 | 14 | 48 | 30.41 | 15 | 55 | 02.4 | 2.524 348 | 3.48 | 1.85 | 10 | 47 | 06 |
| | 22 | 14 | 51 | 13.13 | -16 | 07 | 37.4 | 2.520 763 | 3.49 | 1.86 | 10 | 45 | 52 |
| | 23 | 14 | 53 | 56.35 | 16 | 20 | 05.3 | 2.517 129 | 3.49 | 1.86 | 10 | 44 | 39 |
| | 24 | 14 | 56 | 40.07 | 16 | 32 | 26.1 | 2.513 447 | 3.50 | 1.86 | 10 | 43 | 27 |
| | 25 | 14 | 59 | 24.30 | 16 | 44 | 39.5 | 2.509 717 | 3.50 | 1.86 | 10 | 42 | 15 |
| | 26 | 15 | 02 | 09.03 | 16 | 56 | 45.6 | 2.505 938 | 3.51 | 1.87 | 10 | 41 | 03 |
| | 27 | 15 | 04 | 54.28 | 17 | 08 | 44.1 | 2.502 112 | 3.51 | 1.87 | 10 | 39 | 52 |
| | 28 | 15 | 07 | 40.04 | -17 | 20 | 34.8 | 2.498 239 | 3.52 | 1.87 | 10 | 38 | 41 |
| | 29 | 15 | 10 | 26.32 | 17 | 32 | 17.8 | 2.494 317 | 3.53 | 1.88 | 10 | 37 | 31 |
| | 30 | 15 | 13 | 13.11 | 17 | 43 | 52.6 | 2.490 348 | 3.53 | 1.88 | 10 | 36 | 22 |
| Dec. | 1 | 15 | 16 | 00.42 | 17 | 55 | 19.4 | 2.486 332 | 3.54 | 1.88 | 10 | 35 | 13 |
| | 2 | 15 | 18 | 48.26 | 18 | 06 | 37.8 | 2.482 269 | 3.54 | 1.89 | 10 | 34 | 05 |
| | 3 | 15 | 21 | 36.62 | 18 | 17 | 47.8 | 2.478 158 | 3.55 | 1.89 | 10 | 32 | 57 |
| | 4 | 15 | 24 | 25.50 | -18 | 28 | 49.3 | 2.474 001 | 3.55 | 1.89 | 10 | 31 | 49 |
| | 5 | 15 | 27 | 14.90 | 18 | 39 | 42.0 | 2.469 797 | 3.56 | 1.89 | 10 | 30 | 42 |
| | 6 | 15 | 30 | 04.82 | 18 | 50 | 25.9 | 2.465 548 | 3.57 | 1.90 | 10 | 29 | 36 |
| | 7 | 15 | 32 | 55.24 | 19 | 01 | 00.7 | 2.461 254 | 3.57 | 1.90 | 10 | 28 | 30 |
| | 8 | 15 | 35 | 46.17 | 19 | 11 | 26.4 | 2.456 916 | 3.58 | 1.90 | 10 | 27 | 25 |
| | 9 | 15 | 38 | 37.61 | 19 | 21 | 42.7 | 2.452 535 | 3.59 | 1.91 | 10 | 26 | 20 |
| | 10 | 15 | 41 | 29.55 | -19 | 31 | 49.5 | 2.448 110 | 3.59 | 1.91 | 10 | 25 | 16 |
| | 11 | 15 | 44 | 21.99 | 19 | 41 | 46.7 | 2.443 645 | 3.60 | 1.92 | 10 | 24 | 12 |
| | 12 | 15 | 47 | 14.94 | 19 | 51 | 34.2 | 2.439 138 | 3.61 | 1.92 | 10 | 23 | 08 |
| | 13 | 15 | 50 | 08.39 | 20 | 01 | 11.7 | 2.434 591 | 3.61 | 1.92 | 10 | 22 | 06 |
| | 14 | 15 | 53 | 02.35 | 20 | 10 | 39.3 | 2.430 005 | 3.62 | 1.93 | 10 | 21 | 03 |
| | 15 | 15 | 55 | 56.82 | 20 | 19 | 56.7 | 2.425 379 | 3.63 | 1.93 | 10 | 20 | 01 |
| | 16 | 15 | 58 | 51.80 | -20 | 29 | 03.8 | 2.420 715 | 3.63 | 1.93 | 10 | 19 | 00 |
| | 17 | 16 | 01 | 47.28 | 20 | 38 | 00.5 | 2.416 013 | 3.64 | 1.94 | 10 | 17 | 59 |
| | 18 | 16 | 04 | 43.26 | 20 | 46 | 46.8 | 2.411 274 | 3.65 | 1.94 | 10 | 16 | 59 |
| | 19 | 16 | 07 | 39.75 | 20 | 55 | 22.4 | 2.406 498 | 3.65 | 1.94 | 10 | 15 | 59 |
| | 20 | 16 | 10 | 36.73 | 21 | 03 | 47.3 | 2.401 686 | 3.66 | 1.95 | 10 | 14 | 60 |
| | 21 | 16 | 13 | 34.21 | 21 | 12 | 01.2 | 2.396 837 | 3.67 | 1.95 | 10 | 14 | 01 |
| | 22 | 16 | 16 | 32.19 | -21 | 20 | 04.2 | 2.391 953 | 3.68 | 1.96 | 10 | 13 | 03 |
| | 23 | 16 | 19 | 30.65 | 21 | 27 | 56.0 | 2.387 033 | 3.68 | 1.96 | 10 | 12 | 05 |
| | 24 | 16 | 22 | 29.59 | 21 | 35 | 36.6 | 2.382 077 | 3.69 | 1.96 | 10 | 11 | 07 |
| | 25 | 16 | 25 | 29.02 | 21 | 43 | 05.7 | 2.377 087 | 3.70 | 1.97 | 10 | 10 | 11 |
| | 26 | 16 | 28 | 28.92 | 21 | 50 | 23.3 | 2.372 063 | 3.71 | 1.97 | 10 | 09 | 14 |
| | 27 | 16 | 31 | 29.29 | 21 | 57 | 29.2 | 2.367 003 | 3.72 | 1.98 | 10 | 08 | 18 |
| | 28 | 16 | 34 | 30.13 | -22 | 04 | 23.4 | 2.361 909 | 3.72 | 1.98 | 10 | 07 | 23 |
| | 29 | 16 | 37 | 31.44 | 22 | 11 | 05.6 | 2.356 782 | 3.73 | 1.99 | 10 | 06 | 28 |
| | 30 | 16 | 40 | 33.20 | 22 | 17 | 35.8 | 2.351 620 | 3.74 | 1.99 | 10 | 05 | 33 |
| | 31 | 16 | 43 | 35.41 | 22 | 23 | 53.8 | 2.346 424 | 3.75 | 1.99 | 10 | 04 | 39 |
| | 32 | 16 | 46 | 38.06 | -22 | 29 | 59.6 | 2.341 196 | 3.76 | 2.00 | 10 | 03 | 45 |

**JUPITER, 2021**

HELIOCENTRIC POSITIONS FOR $0^h$ TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

| Date | | Heliocentric Longitude ° | ′ | ″ | Heliocentric Latitude ° | ′ | ″ | Radius Vector | Date | | Heliocentric Longitude ° | ′ | ″ | Heliocentric Latitude ° | ′ | ″ | Radius Vector |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan. | 1 | 306 | 56 | 29.9 | -0 | 34 | 34.6 | 5.095 714 | Apr. | 3 | 314 | 57 | 08.7 | -0 | 44 | 00.4 | 5.065 588 |
| | 3 | 307 | 06 | 53.1 | 0 | 34 | 47.3 | 5.095 037 | | 5 | 315 | 07 | 39.4 | 0 | 44 | 12.3 | 5.064 958 |
| | 5 | 307 | 17 | 16.5 | 0 | 34 | 60.0 | 5.094 361 | | 7 | 315 | 18 | 10.2 | 0 | 44 | 24.1 | 5.064 330 |
| | 7 | 307 | 27 | 40.1 | 0 | 35 | 12.6 | 5.093 687 | | 9 | 315 | 28 | 41.2 | 0 | 44 | 35.9 | 5.063 702 |
| | 9 | 307 | 38 | 03.8 | 0 | 35 | 25.3 | 5.093 013 | | 11 | 315 | 39 | 12.4 | 0 | 44 | 47.6 | 5.063 076 |
| | 11 | 307 | 48 | 27.8 | 0 | 35 | 37.9 | 5.092 339 | | 13 | 315 | 49 | 43.7 | 0 | 44 | 59.4 | 5.062 450 |
| | 13 | 307 | 58 | 51.8 | -0 | 35 | 50.5 | 5.091 667 | | 15 | 316 | 00 | 15.2 | -0 | 45 | 11.1 | 5.061 826 |
| | 15 | 308 | 09 | 16.1 | 0 | 36 | 03.1 | 5.090 996 | | 17 | 316 | 10 | 46.9 | 0 | 45 | 22.8 | 5.061 203 |
| | 17 | 308 | 19 | 40.5 | 0 | 36 | 15.7 | 5.090 325 | | 19 | 316 | 21 | 18.7 | 0 | 45 | 34.5 | 5.060 582 |
| | 19 | 308 | 30 | 05.1 | 0 | 36 | 28.3 | 5.089 656 | | 21 | 316 | 31 | 50.7 | 0 | 45 | 46.2 | 5.059 961 |
| | 21 | 308 | 40 | 29.8 | 0 | 36 | 40.8 | 5.088 987 | | 23 | 316 | 42 | 22.8 | 0 | 45 | 57.8 | 5.059 342 |
| | 23 | 308 | 50 | 54.7 | 0 | 36 | 53.4 | 5.088 320 | | 25 | 316 | 52 | 55.0 | 0 | 46 | 09.4 | 5.058 724 |
| | 25 | 309 | 01 | 19.8 | -0 | 37 | 05.9 | 5.087 653 | | 27 | 317 | 03 | 27.5 | -0 | 46 | 21.0 | 5.058 107 |
| | 27 | 309 | 11 | 45.0 | 0 | 37 | 18.4 | 5.086 987 | | 29 | 317 | 14 | 00.1 | 0 | 46 | 32.6 | 5.057 491 |
| | 29 | 309 | 22 | 10.4 | 0 | 37 | 30.9 | 5.086 323 | May | 1 | 317 | 24 | 32.8 | 0 | 46 | 44.1 | 5.056 877 |
| | 31 | 309 | 32 | 35.9 | 0 | 37 | 43.3 | 5.085 659 | | 3 | 317 | 35 | 05.7 | 0 | 46 | 55.6 | 5.056 264 |
| Feb. | 2 | 309 | 43 | 01.6 | 0 | 37 | 55.8 | 5.084 996 | | 5 | 317 | 45 | 38.7 | 0 | 47 | 07.1 | 5.055 652 |
| | 4 | 309 | 53 | 27.5 | 0 | 38 | 08.2 | 5.084 334 | | 7 | 317 | 56 | 11.9 | 0 | 47 | 18.6 | 5.055 041 |
| | 6 | 310 | 03 | 53.6 | -0 | 38 | 20.7 | 5.083 673 | | 9 | 318 | 06 | 45.3 | -0 | 47 | 30.0 | 5.054 432 |
| | 8 | 310 | 14 | 19.8 | 0 | 38 | 33.1 | 5.083 013 | | 11 | 318 | 17 | 18.8 | 0 | 47 | 41.5 | 5.053 824 |
| | 10 | 310 | 24 | 46.2 | 0 | 38 | 45.4 | 5.082 354 | | 13 | 318 | 27 | 52.4 | 0 | 47 | 52.9 | 5.053 217 |
| | 12 | 310 | 35 | 12.7 | 0 | 38 | 57.8 | 5.081 696 | | 15 | 318 | 38 | 26.2 | 0 | 48 | 04.2 | 5.052 612 |
| | 14 | 310 | 45 | 39.4 | 0 | 39 | 10.1 | 5.081 039 | | 17 | 318 | 49 | 00.2 | 0 | 48 | 15.6 | 5.052 007 |
| | 16 | 310 | 56 | 06.3 | 0 | 39 | 22.4 | 5.080 383 | | 19 | 318 | 59 | 34.3 | 0 | 48 | 26.9 | 5.051 404 |
| | 18 | 311 | 06 | 33.3 | -0 | 39 | 34.7 | 5.079 728 | | 21 | 319 | 10 | 08.6 | -0 | 48 | 38.2 | 5.050 803 |
| | 20 | 311 | 17 | 00.5 | 0 | 39 | 47.0 | 5.079 075 | | 23 | 319 | 20 | 43.0 | 0 | 48 | 49.5 | 5.050 202 |
| | 22 | 311 | 27 | 27.9 | 0 | 39 | 59.3 | 5.078 422 | | 25 | 319 | 31 | 17.6 | 0 | 49 | 00.8 | 5.049 603 |
| | 24 | 311 | 37 | 55.4 | 0 | 40 | 11.5 | 5.077 770 | | 27 | 319 | 41 | 52.3 | 0 | 49 | 12.0 | 5.049 006 |
| | 26 | 311 | 48 | 23.0 | 0 | 40 | 23.8 | 5.077 119 | | 29 | 319 | 52 | 27.2 | 0 | 49 | 23.2 | 5.048 409 |
| | 28 | 311 | 58 | 50.9 | 0 | 40 | 36.0 | 5.076 469 | | 31 | 320 | 03 | 02.2 | 0 | 49 | 34.3 | 5.047 814 |
| Mar. | 2 | 312 | 09 | 18.9 | -0 | 40 | 48.2 | 5.075 820 | June | 2 | 320 | 13 | 37.4 | -0 | 49 | 45.5 | 5.047 220 |
| | 4 | 312 | 19 | 47.0 | 0 | 41 | 00.3 | 5.075 173 | | 4 | 320 | 24 | 12.7 | 0 | 49 | 56.6 | 5.046 628 |
| | 6 | 312 | 30 | 15.4 | 0 | 41 | 12.5 | 5.074 526 | | 6 | 320 | 34 | 48.2 | 0 | 50 | 07.7 | 5.046 037 |
| | 8 | 312 | 40 | 43.8 | 0 | 41 | 24.6 | 5.073 881 | | 8 | 320 | 45 | 23.8 | 0 | 50 | 18.8 | 5.045 447 |
| | 10 | 312 | 51 | 12.5 | 0 | 41 | 36.7 | 5.073 236 | | 10 | 320 | 55 | 59.6 | 0 | 50 | 29.8 | 5.044 859 |
| | 12 | 313 | 01 | 41.3 | 0 | 41 | 48.8 | 5.072 593 | | 12 | 321 | 06 | 35.5 | 0 | 50 | 40.9 | 5.044 272 |
| | 14 | 313 | 12 | 10.2 | -0 | 42 | 00.9 | 5.071 950 | | 14 | 321 | 17 | 11.6 | -0 | 50 | 51.9 | 5.043 686 |
| | 16 | 313 | 22 | 39.4 | 0 | 42 | 12.9 | 5.071 309 | | 16 | 321 | 27 | 47.8 | 0 | 51 | 02.8 | 5.043 102 |
| | 18 | 313 | 33 | 08.6 | 0 | 42 | 24.9 | 5.070 669 | | 18 | 321 | 38 | 24.1 | 0 | 51 | 13.8 | 5.042 519 |
| | 20 | 313 | 43 | 38.1 | 0 | 42 | 37.0 | 5.070 030 | | 20 | 321 | 49 | 00.7 | 0 | 51 | 24.7 | 5.041 938 |
| | 22 | 313 | 54 | 07.7 | 0 | 42 | 48.9 | 5.069 392 | | 22 | 321 | 59 | 37.3 | 0 | 51 | 35.6 | 5.041 358 |
| | 24 | 314 | 04 | 37.5 | 0 | 43 | 00.9 | 5.068 755 | | 24 | 322 | 10 | 14.2 | 0 | 51 | 46.4 | 5.040 779 |
| | 26 | 314 | 15 | 07.4 | -0 | 43 | 12.9 | 5.068 120 | | 26 | 322 | 20 | 51.1 | -0 | 51 | 57.3 | 5.040 202 |
| | 28 | 314 | 25 | 37.5 | 0 | 43 | 24.8 | 5.067 485 | | 28 | 322 | 31 | 28.2 | 0 | 52 | 08.0 | 5.039 626 |
| | 30 | 314 | 36 | 07.7 | 0 | 43 | 36.7 | 5.066 852 | | 30 | 322 | 42 | 05.5 | 0 | 52 | 18.9 | 5.039 051 |
| Apr. | 1 | 314 | 46 | 38.1 | 0 | 43 | 48.6 | 5.066 220 | July | 2 | 322 | 52 | 42.8 | 0 | 52 | 29.6 | 5.038 478 |
| | 3 | 314 | 57 | 08.7 | -0 | 44 | 00.4 | 5.065 588 | | 4 | 323 | 03 | 20.4 | -0 | 52 | 40.3 | 5.037 907 |

**JUPITER, 2021**

HELIOCENTRIC POSITIONS FOR $0^h$ TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

| Date | | Heliocentric Longitude ° | ′ | ″ | Heliocentric Latitude ° | ′ | ″ | Radius Vector |
|---|---|---|---|---|---|---|---|---|
| July | 2 | 322 | 52 | 43 | -0 | 52 | 29.6 | 5.038 478 |
| | 4 | 323 | 03 | 20 | 0 | 52 | 40.3 | 5.037 907 |
| | 6 | 323 | 13 | 58 | 0 | 52 | 51.0 | 5.037 337 |
| | 8 | 323 | 24 | 36 | 0 | 53 | 01.7 | 5.036 768 |
| | 10 | 323 | 35 | 14 | 0 | 53 | 12.3 | 5.036 201 |
| | 12 | 323 | 45 | 52 | 0 | 53 | 22.9 | 5.035 635 |
| | 14 | 323 | 56 | 30 | -0 | 53 | 33.5 | 5.035 070 |
| | 16 | 324 | 07 | 9 | 0 | 53 | 44.1 | 5.034 507 |
| | 18 | 324 | 17 | 47 | 0 | 53 | 54.6 | 5.033 946 |
| | 20 | 324 | 28 | 26 | 0 | 54 | 05.1 | 5.033 386 |
| | 22 | 324 | 39 | 5 | 0 | 54 | 15.5 | 5.032 827 |
| | 24 | 324 | 49 | 44 | 0 | 54 | 26.0 | 5.032 270 |
| | 26 | 325 | 00 | 23 | -0 | 54 | 36.4 | 5.031 715 |
| | 28 | 325 | 11 | 2 | 0 | 54 | 46.8 | 5.031 160 |
| | 30 | 325 | 21 | 42 | 0 | 54 | 57.1 | 5.030 608 |
| Aug. | 1 | 325 | 32 | 21 | 0 | 55 | 07.5 | 5.030 057 |
| | 3 | 325 | 43 | 1 | 0 | 55 | 17.8 | 5.029 507 |
| | 5 | 325 | 53 | 41 | 0 | 55 | 28.0 | 5.028 959 |
| | 7 | 326 | 04 | 21 | -0 | 55 | 38.2 | 5.028 413 |
| | 9 | 326 | 15 | 1 | 0 | 55 | 48.5 | 5.027 868 |
| | 11 | 326 | 25 | 41 | 0 | 55 | 58.6 | 5.027 324 |
| | 13 | 326 | 36 | 21 | 0 | 56 | 08.8 | 5.026 782 |
| | 15 | 326 | 47 | 2 | 0 | 56 | 18.9 | 5.026 242 |
| | 17 | 326 | 57 | 43 | 0 | 56 | 29.0 | 5.025 703 |
| | 19 | 327 | 08 | 23 | -0 | 56 | 39.0 | 5.025 165 |
| | 21 | 327 | 19 | 4 | 0 | 56 | 49.0 | 5.024 630 |
| | 23 | 327 | 29 | 45 | 0 | 56 | 59.0 | 5.024 095 |
| | 25 | 327 | 40 | 27 | 0 | 57 | 09.0 | 5.023 563 |
| | 27 | 327 | 51 | 8 | 0 | 57 | 18.9 | 5.023 032 |
| | 29 | 328 | 01 | 49 | 0 | 57 | 28.8 | 5.022 502 |
| | 31 | 328 | 12 | 31 | -0 | 57 | 38.7 | 5.021 974 |
| Sept. | 2 | 328 | 23 | 13 | 0 | 57 | 48.5 | 5.021 448 |
| | 4 | 328 | 33 | 55 | 0 | 57 | 58.3 | 5.020 923 |
| | 6 | 328 | 44 | 37 | 0 | 58 | 08.1 | 5.020 400 |
| | 8 | 328 | 55 | 19 | 0 | 58 | 17.9 | 5.019 879 |
| | 10 | 329 | 06 | 1 | 0 | 58 | 27.6 | 5.019 359 |
| | 12 | 329 | 16 | 44 | -0 | 58 | 37.3 | 5.018 840 |
| | 14 | 329 | 27 | 26 | 0 | 58 | 46.9 | 5.018 323 |
| | 16 | 329 | 38 | 9 | 0 | 58 | 56.5 | 5.017 808 |
| | 18 | 329 | 48 | 52 | 0 | 59 | 06.1 | 5.017 295 |
| | 20 | 329 | 59 | 35 | 0 | 59 | 15.6 | 5.016 783 |
| | 22 | 330 | 10 | 18 | 0 | 59 | 25.1 | 5.016 273 |
| | 24 | 330 | 21 | 1 | -0 | 59 | 34.6 | 5.015 764 |
| | 26 | 330 | 31 | 44 | 0 | 59 | 44.1 | 5.015 257 |
| | 28 | 330 | 42 | 28 | 0 | 59 | 53.5 | 5.014 752 |
| | 30 | 330 | 53 | 12 | 1 | 00 | 02.9 | 5.014 248 |
| Oct. | 2 | 331 | 03 | 55 | -1 | 00 | 12.2 | 5.013 746 |

| Date | | Heliocentric Longitude ° | ′ | ″ | Heliocentric Latitude ° | ′ | ″ | Radius Vector |
|---|---|---|---|---|---|---|---|---|
| Oct. | 2 | 331 | 03 | 55.2 | -1 | 00 | 12.2 | 5.013 746 |
| | 4 | 331 | 14 | 39.1 | 1 | 00 | 21.5 | 5.013 246 |
| | 6 | 331 | 25 | 23.1 | 1 | 00 | 30.8 | 5.012 747 |
| | 8 | 331 | 36 | 07.3 | 1 | 00 | 40.1 | 5.012 250 |
| | 10 | 331 | 46 | 51.5 | 1 | 00 | 49.3 | 5.011 755 |
| | 12 | 331 | 57 | 36.0 | 1 | 00 | 58.5 | 5.011 262 |
| | 14 | 332 | 08 | 20.4 | -1 | 01 | 07.6 | 5.010 770 |
| | 16 | 332 | 19 | 05.1 | 1 | 01 | 16.7 | 5.010 279 |
| | 18 | 332 | 29 | 49.9 | 1 | 01 | 25.8 | 5.009 791 |
| | 20 | 332 | 40 | 34.8 | 1 | 01 | 34.9 | 5.009 304 |
| | 22 | 332 | 51 | 19.8 | 1 | 01 | 43.9 | 5.008 819 |
| | 24 | 333 | 02 | 05.0 | 1 | 01 | 52.9 | 5.008 336 |
| | 26 | 333 | 12 | 50.2 | -1 | 02 | 01.8 | 5.007 854 |
| | 28 | 333 | 23 | 35.6 | 1 | 02 | 10.7 | 5.007 374 |
| | 30 | 333 | 34 | 21.2 | 1 | 02 | 19.6 | 5.006 896 |
| Nov. | 1 | 333 | 45 | 06.8 | 1 | 02 | 28.4 | 5.006 420 |
| | 3 | 333 | 55 | 52.6 | 1 | 02 | 37.2 | 5.005 945 |
| | 5 | 334 | 06 | 38.5 | 1 | 02 | 46.0 | 5.005 472 |
| | 7 | 334 | 17 | 24.5 | -1 | 02 | 54.7 | 5.005 001 |
| | 9 | 334 | 28 | 10.6 | 1 | 03 | 03.4 | 5.004 531 |
| | 11 | 334 | 38 | 56.9 | 1 | 03 | 12.1 | 5.004 064 |
| | 13 | 334 | 49 | 43.3 | 1 | 03 | 20.7 | 5.003 598 |
| | 15 | 335 | 00 | 29.8 | 1 | 03 | 29.3 | 5.003 134 |
| | 17 | 335 | 11 | 16.4 | 1 | 03 | 37.9 | 5.002 671 |
| | 19 | 335 | 22 | 03.2 | -1 | 03 | 46.4 | 5.002 211 |
| | 21 | 335 | 32 | 50.0 | 1 | 03 | 54.9 | 5.001 752 |
| | 23 | 335 | 43 | 37.0 | 1 | 04 | 03.3 | 5.001 295 |
| | 25 | 335 | 54 | 24.1 | 1 | 04 | 11.7 | 5.000 840 |
| | 27 | 336 | 05 | 11.3 | 1 | 04 | 20.1 | 5.000 386 |
| | 29 | 336 | 15 | 58.6 | 1 | 04 | 28.4 | 4.999 935 |
| Dec. | 1 | 336 | 26 | 46.1 | -1 | 04 | 36.7 | 4.999 485 |
| | 3 | 336 | 37 | 33.6 | 1 | 04 | 45.0 | 4.999 037 |
| | 5 | 336 | 48 | 21.3 | 1 | 04 | 53.2 | 4.998 591 |
| | 7 | 336 | 59 | 09.1 | 1 | 05 | 01.4 | 4.998 147 |
| | 9 | 337 | 09 | 57.1 | 1 | 05 | 09.6 | 4.997 704 |
| | 11 | 337 | 20 | 45.1 | 1 | 05 | 17.7 | 4.997 264 |
| | 13 | 337 | 31 | 33.2 | -1 | 05 | 25.8 | 4.996 825 |
| | 15 | 337 | 42 | 21.5 | 1 | 05 | 33.8 | 4.996 388 |
| | 17 | 337 | 53 | 09.8 | 1 | 05 | 41.8 | 4.995 953 |
| | 19 | 338 | 03 | 58.3 | 1 | 05 | 49.8 | 4.995 520 |
| | 21 | 338 | 14 | 46.9 | 1 | 05 | 57.7 | 4.995 088 |
| | 23 | 338 | 25 | 35.6 | 1 | 06 | 05.6 | 4.994 659 |
| | 25 | 338 | 36 | 24.5 | -1 | 06 | 13.4 | 4.994 231 |
| | 27 | 338 | 47 | 13.4 | 1 | 06 | 21.3 | 4.993 805 |
| | 29 | 338 | 58 | 02.4 | 1 | 06 | 29.0 | 4.993 382 |
| | 31 | 339 | 08 | 51.6 | 1 | 06 | 36.8 | 4.992 960 |
| | 33 | 339 | 19 | 40.8 | -1 | 06 | 44.5 | 4.992 540 |

**JUPITER, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| Jan. | 0 | 302 | 33 | 17.8 | -0 | 29 | 19.9 | Feb. | 15 | 313 | 22 | 11.5 | -0 | 33 | 02.7 |
| | 1 | 302 | 46 | 58.0 | 0 | 29 | 23.5 | | 16 | 313 | 36 | 15.9 | 0 | 33 | 09.0 |
| | 2 | 303 | 00 | 40.6 | 0 | 29 | 27.1 | | 17 | 313 | 50 | 18.8 | 0 | 33 | 15.4 |
| | 3 | 303 | 14 | 25.4 | 0 | 29 | 30.8 | | 18 | 314 | 04 | 20.3 | 0 | 33 | 21.9 |
| | 4 | 303 | 28 | 12.3 | 0 | 29 | 34.6 | | 19 | 314 | 18 | 20.3 | 0 | 33 | 28.4 |
| | 5 | 303 | 42 | 01.4 | 0 | 29 | 38.3 | | 20 | 314 | 32 | 18.6 | 0 | 33 | 35.0 |
| | 6 | 303 | 55 | 52.6 | -0 | 29 | 42.2 | | 21 | 314 | 46 | 15.3 | -0 | 33 | 41.6 |
| | 7 | 304 | 09 | 45.7 | 0 | 29 | 46.1 | | 22 | 315 | 00 | 10.1 | 0 | 33 | 48.4 |
| | 8 | 304 | 23 | 40.9 | 0 | 29 | 50.0 | | 23 | 315 | 14 | 03.1 | 0 | 33 | 55.2 |
| | 9 | 304 | 37 | 37.9 | 0 | 29 | 54.1 | | 24 | 315 | 27 | 54.2 | 0 | 34 | 02.1 |
| | 10 | 304 | 51 | 36.7 | 0 | 29 | 58.1 | | 25 | 315 | 41 | 43.2 | 0 | 34 | 09.1 |
| | 11 | 305 | 05 | 37.3 | 0 | 30 | 02.2 | | 26 | 315 | 55 | 30.0 | 0 | 34 | 16.1 |
| | 12 | 305 | 19 | 39.5 | -0 | 30 | 06.4 | | 27 | 316 | 09 | 14.7 | -0 | 34 | 23.2 |
| | 13 | 305 | 33 | 43.1 | 0 | 30 | 10.6 | | 28 | 316 | 22 | 57.0 | 0 | 34 | 30.5 |
| | 14 | 305 | 47 | 48.0 | 0 | 30 | 14.9 | Mar. | 1 | 316 | 36 | 37.0 | 0 | 34 | 37.8 |
| | 15 | 306 | 01 | 54.2 | 0 | 30 | 19.2 | | 2 | 316 | 50 | 14.7 | 0 | 34 | 45.1 |
| | 16 | 306 | 16 | 01.6 | 0 | 30 | 23.6 | | 3 | 317 | 03 | 50.0 | 0 | 34 | 52.6 |
| | 17 | 306 | 30 | 09.9 | 0 | 30 | 28.1 | | 4 | 317 | 17 | 22.8 | 0 | 35 | 00.1 |
| | 18 | 306 | 44 | 19.3 | -0 | 30 | 32.5 | | 5 | 317 | 30 | 53.0 | -0 | 35 | 07.8 |
| | 19 | 306 | 58 | 29.5 | 0 | 30 | 37.1 | | 6 | 317 | 44 | 20.7 | 0 | 35 | 15.5 |
| | 20 | 307 | 12 | 40.6 | 0 | 30 | 41.7 | | 7 | 317 | 57 | 45.6 | 0 | 35 | 23.3 |
| | 21 | 307 | 26 | 52.5 | 0 | 30 | 46.3 | | 8 | 318 | 11 | 07.7 | 0 | 35 | 31.1 |
| | 22 | 307 | 41 | 05.0 | 0 | 30 | 51.0 | | 9 | 318 | 24 | 26.8 | 0 | 35 | 39.1 |
| | 23 | 307 | 55 | 18.2 | 0 | 30 | 55.8 | | 10 | 318 | 37 | 42.8 | 0 | 35 | 47.1 |
| | 24 | 308 | 09 | 31.9 | -0 | 31 | 00.6 | | 11 | 318 | 50 | 55.6 | -0 | 35 | 55.3 |
| | 25 | 308 | 23 | 46.1 | 0 | 31 | 05.4 | | 12 | 319 | 04 | 05.2 | 0 | 36 | 03.4 |
| | 26 | 308 | 38 | 00.7 | 0 | 31 | 10.4 | | 13 | 319 | 17 | 11.4 | 0 | 36 | 11.7 |
| | 27 | 308 | 52 | 15.6 | 0 | 31 | 15.4 | | 14 | 319 | 30 | 14.2 | 0 | 36 | 20.1 |
| | 28 | 309 | 06 | 30.7 | 0 | 31 | 20.6 | | 15 | 319 | 43 | 13.4 | 0 | 36 | 28.5 |
| | 29 | 309 | 20 | 45.6 | 0 | 31 | 26.2 | | 16 | 319 | 56 | 09.1 | 0 | 36 | 37.0 |
| | 30 | 309 | 35 | 00.3 | -0 | 31 | 30.9 | | 17 | 320 | 09 | 01.1 | -0 | 36 | 45.6 |
| | 31 | 309 | 49 | 15.5 | 0 | 31 | 36.0 | | 18 | 320 | 21 | 49.3 | 0 | 36 | 54.3 |
| Feb. | 1 | 310 | 03 | 30.5 | 0 | 31 | 41.3 | | 19 | 320 | 34 | 33.7 | 0 | 37 | 03.1 |
| | 2 | 310 | 17 | 45.4 | 0 | 31 | 46.6 | | 20 | 320 | 47 | 14.2 | 0 | 37 | 12.0 |
| | 3 | 310 | 32 | 00.1 | 0 | 31 | 52.1 | | 21 | 320 | 59 | 50.7 | 0 | 37 | 20.9 |
| | 4 | 310 | 46 | 14.5 | 0 | 31 | 57.6 | | 22 | 321 | 12 | 23.1 | 0 | 37 | 30.0 |
| | 5 | 311 | 00 | 28.5 | -0 | 32 | 03.2 | | 23 | 321 | 24 | 51.4 | -0 | 37 | 39.1 |
| | 6 | 311 | 14 | 42.3 | 0 | 32 | 08.8 | | 24 | 321 | 37 | 15.3 | 0 | 37 | 48.3 |
| | 7 | 311 | 28 | 55.5 | 0 | 32 | 14.6 | | 25 | 321 | 49 | 34.8 | 0 | 37 | 57.7 |
| | 8 | 311 | 43 | 08.2 | 0 | 32 | 20.3 | | 26 | 322 | 01 | 49.9 | 0 | 38 | 07.1 |
| | 9 | 311 | 57 | 20.2 | 0 | 32 | 26.2 | | 27 | 322 | 14 | 00.4 | 0 | 38 | 16.6 |
| | 10 | 312 | 11 | 31.3 | 0 | 32 | 32.1 | | 28 | 322 | 26 | 06.3 | 0 | 38 | 26.2 |
| | 11 | 312 | 25 | 41.6 | -0 | 32 | 38.1 | | 29 | 322 | 38 | 07.5 | -0 | 38 | 35.9 |
| | 12 | 312 | 39 | 50.8 | 0 | 32 | 44.2 | | 30 | 322 | 50 | 04.1 | 0 | 38 | 45.7 |
| | 13 | 312 | 53 | 58.9 | 0 | 32 | 50.3 | | 31 | 323 | 01 | 55.9 | 0 | 38 | 55.6 |
| | 14 | 313 | 08 | 05.9 | 0 | 32 | 56.5 | Apr. | 1 | 323 | 13 | 42.8 | 0 | 39 | 05.6 |
| | 15 | 313 | 22 | 11.5 | -0 | 33 | 02.7 | | 2 | 323 | 25 | 24.9 | -0 | 39 | 15.7 |

**JUPITER, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| Apr. | 1 | 323 | 13 | 42.8 | -0 | 39 | 05.6 | May | 17 | 330 | 19 | 43.2 | -0 | 48 | 33.0 |
| | 2 | 323 | 25 | 24.9 | 0 | 39 | 15.7 | | 18 | 330 | 25 | 51.1 | 0 | 48 | 47.7 |
| | 3 | 323 | 37 | 01.9 | 0 | 39 | 25.9 | | 19 | 330 | 31 | 49.4 | 0 | 49 | 02.4 |
| | 4 | 323 | 48 | 33.8 | 0 | 39 | 36.2 | | 20 | 330 | 37 | 38.0 | 0 | 49 | 17.3 |
| | 5 | 324 | 00 | 00.4 | 0 | 39 | 46.6 | | 21 | 330 | 43 | 16.8 | 0 | 49 | 32.3 |
| | 6 | 324 | 11 | 21.6 | 0 | 39 | 57.1 | | 22 | 330 | 48 | 45.8 | 0 | 49 | 47.3 |
| | 7 | 324 | 22 | 37.2 | -0 | 40 | 07.7 | | 23 | 330 | 54 | 05.0 | -0 | 50 | 02.5 |
| | 8 | 324 | 33 | 47.3 | 0 | 40 | 18.4 | | 24 | 330 | 59 | 14.2 | 0 | 50 | 17.7 |
| | 9 | 324 | 44 | 51.6 | 0 | 40 | 29.1 | | 25 | 331 | 04 | 13.5 | 0 | 50 | 33.0 |
| | 10 | 324 | 55 | 50.1 | 0 | 40 | 40.0 | | 26 | 331 | 09 | 02.8 | 0 | 50 | 48.4 |
| | 11 | 325 | 06 | 42.7 | 0 | 40 | 50.9 | | 27 | 331 | 13 | 41.9 | 0 | 51 | 03.9 |
| | 12 | 325 | 17 | 29.4 | 0 | 41 | 02.0 | | 28 | 331 | 18 | 10.9 | 0 | 51 | 19.5 |
| | 13 | 325 | 28 | 09.9 | -0 | 41 | 13.1 | | 29 | 331 | 22 | 29.6 | -0 | 51 | 35.2 |
| | 14 | 325 | 38 | 44.3 | 0 | 41 | 24.4 | | 30 | 331 | 26 | 37.8 | 0 | 51 | 50.9 |
| | 15 | 325 | 49 | 12.5 | 0 | 41 | 35.7 | | 31 | 331 | 30 | 35.4 | 0 | 52 | 06.7 |
| | 16 | 325 | 59 | 34.3 | 0 | 41 | 47.2 | June | 1 | 331 | 34 | 22.4 | 0 | 52 | 22.5 |
| | 17 | 326 | 09 | 49.7 | 0 | 41 | 58.7 | | 2 | 331 | 37 | 58.6 | 0 | 52 | 38.5 |
| | 18 | 326 | 19 | 58.5 | 0 | 42 | 10.4 | | 3 | 331 | 41 | 23.9 | 0 | 52 | 54.5 |
| | 19 | 326 | 30 | 00.7 | -0 | 42 | 22.1 | | 4 | 331 | 44 | 38.4 | -0 | 53 | 10.5 |
| | 20 | 326 | 39 | 56.1 | 0 | 42 | 34.0 | | 5 | 331 | 47 | 41.9 | 0 | 53 | 26.6 |
| | 21 | 326 | 49 | 44.6 | 0 | 42 | 45.9 | | 6 | 331 | 50 | 34.4 | 0 | 53 | 42.8 |
| | 22 | 326 | 59 | 26.2 | 0 | 42 | 58.0 | | 7 | 331 | 53 | 15.8 | 0 | 53 | 59.0 |
| | 23 | 327 | 09 | 00.7 | 0 | 43 | 10.2 | | 8 | 331 | 55 | 46.1 | 0 | 54 | 15.3 |
| | 24 | 327 | 18 | 28.1 | 0 | 43 | 22.5 | | 9 | 331 | 58 | 05.2 | 0 | 54 | 31.6 |
| | 25 | 327 | 27 | 48.3 | -0 | 43 | 34.8 | | 10 | 332 | 00 | 13.0 | -0 | 54 | 47.9 |
| | 26 | 327 | 37 | 01.2 | 0 | 43 | 47.3 | | 11 | 332 | 02 | 09.5 | 0 | 55 | 04.3 |
| | 27 | 327 | 46 | 06.9 | 0 | 43 | 59.9 | | 12 | 332 | 03 | 54.6 | 0 | 55 | 20.8 |
| | 28 | 327 | 55 | 05.1 | 0 | 44 | 12.7 | | 13 | 332 | 05 | 28.4 | 0 | 55 | 37.3 |
| | 29 | 328 | 03 | 56.0 | 0 | 44 | 25.5 | | 14 | 332 | 06 | 50.6 | 0 | 55 | 53.8 |
| | 30 | 328 | 12 | 39.2 | 0 | 44 | 38.4 | | 15 | 332 | 08 | 01.3 | 0 | 56 | 10.4 |
| May | 1 | 328 | 21 | 14.8 | -0 | 44 | 51.4 | | 16 | 332 | 09 | 00.5 | -0 | 56 | 27.0 |
| | 2 | 328 | 29 | 42.6 | 0 | 45 | 04.5 | | 17 | 332 | 09 | 48.1 | 0 | 56 | 43.6 |
| | 3 | 328 | 38 | 02.4 | 0 | 45 | 17.8 | | 18 | 332 | 10 | 24.1 | 0 | 57 | 00.2 |
| | 4 | 328 | 46 | 14.0 | 0 | 45 | 31.1 | | 19 | 332 | 10 | 48.6 | 0 | 57 | 16.9 |
| | 5 | 328 | 54 | 17.5 | 0 | 45 | 44.5 | | 20 | 332 | 11 | 01.6 | 0 | 57 | 33.6 |
| | 6 | 329 | 02 | 12.6 | 0 | 45 | 58.0 | | 21 | 332 | 11 | 03.1 | 0 | 57 | 50.3 |
| | 7 | 329 | 09 | 59.4 | -0 | 46 | 11.6 | | 22 | 332 | 10 | 53.1 | -0 | 58 | 07.0 |
| | 8 | 329 | 17 | 37.6 | 0 | 46 | 25.3 | | 23 | 332 | 10 | 31.7 | 0 | 58 | 23.7 |
| | 9 | 329 | 25 | 07.2 | 0 | 46 | 39.1 | | 24 | 332 | 09 | 58.8 | 0 | 58 | 40.4 |
| | 10 | 329 | 32 | 28.1 | 0 | 46 | 53.0 | | 25 | 332 | 09 | 14.5 | 0 | 58 | 57.0 |
| | 11 | 329 | 39 | 40.3 | 0 | 47 | 07.0 | | 26 | 332 | 08 | 18.6 | 0 | 59 | 13.7 |
| | 12 | 329 | 46 | 43.6 | 0 | 47 | 21.1 | | 27 | 332 | 07 | 11.2 | 0 | 59 | 30.3 |
| | 13 | 329 | 53 | 37.9 | -0 | 47 | 35.3 | | 28 | 332 | 05 | 52.3 | -0 | 59 | 46.9 |
| | 14 | 330 | 00 | 23.1 | 0 | 47 | 49.6 | | 29 | 332 | 04 | 21.8 | 1 | 00 | 03.5 |
| | 15 | 330 | 06 | 59.1 | 0 | 48 | 03.9 | | 30 | 332 | 02 | 39.7 | 1 | 00 | 20.0 |
| | 16 | 330 | 13 | 25.9 | 0 | 48 | 18.4 | July | 1 | 332 | 00 | 46.3 | 1 | 00 | 36.5 |
| | 17 | 330 | 19 | 43.2 | -0 | 48 | 33.0 | | 2 | 331 | 58 | 41.4 | -1 | 00 | 52.9 |

**JUPITER, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| July | 1 | 332 | 00 | 46.3 | -1 | 00 | 36.5 | Aug. | 16 | 327 | 45 | 15.5 | -1 | 10 | 35.0 |
| | 2 | 331 | 58 | 41.4 | 1 | 00 | 52.9 | | 17 | 327 | 37 | 25.3 | 1 | 10 | 42.3 |
| | 3 | 331 | 56 | 25.1 | 1 | 01 | 09.2 | | 18 | 327 | 29 | 34.2 | 1 | 10 | 49.3 |
| | 4 | 331 | 53 | 57.6 | 1 | 01 | 25.5 | | 19 | 327 | 21 | 42.4 | 1 | 10 | 55.9 |
| | 5 | 331 | 51 | 18.8 | 1 | 01 | 41.7 | | 20 | 327 | 13 | 50.4 | 1 | 11 | 02.3 |
| | 6 | 331 | 48 | 28.9 | 1 | 01 | 57.8 | | 21 | 327 | 05 | 58.2 | 1 | 11 | 08.2 |
| | 7 | 331 | 45 | 28.0 | -1 | 02 | 13.9 | | 22 | 326 | 58 | 06.4 | -1 | 11 | 13.9 |
| | 8 | 331 | 42 | 16.0 | 1 | 02 | 29.8 | | 23 | 326 | 50 | 15.2 | 1 | 11 | 19.2 |
| | 9 | 331 | 38 | 53.2 | 1 | 02 | 45.7 | | 24 | 326 | 42 | 25.0 | 1 | 11 | 24.2 |
| | 10 | 331 | 35 | 19.5 | 1 | 03 | 01.5 | | 25 | 326 | 34 | 36.1 | 1 | 11 | 28.8 |
| | 11 | 331 | 31 | 35.2 | 1 | 03 | 17.1 | | 26 | 326 | 26 | 48.8 | 1 | 11 | 33.1 |
| | 12 | 331 | 27 | 40.3 | 1 | 03 | 32.7 | | 27 | 326 | 19 | 03.6 | 1 | 11 | 37.1 |
| | 13 | 331 | 23 | 34.9 | -1 | 03 | 48.1 | | 28 | 326 | 11 | 20.8 | -1 | 11 | 40.8 |
| | 14 | 331 | 19 | 19.3 | 1 | 04 | 03.4 | | 29 | 326 | 03 | 40.7 | 1 | 11 | 44.1 |
| | 15 | 331 | 14 | 53.5 | 1 | 04 | 18.6 | | 30 | 325 | 56 | 03.6 | 1 | 11 | 47.1 |
| | 16 | 331 | 10 | 17.7 | 1 | 04 | 33.7 | | 31 | 325 | 48 | 30.0 | 1 | 11 | 49.7 |
| | 17 | 331 | 05 | 32.2 | 1 | 04 | 48.6 | Sept. | 1 | 325 | 41 | 00.0 | 1 | 11 | 52.0 |
| | 18 | 331 | 00 | 37.2 | 1 | 05 | 03.3 | | 2 | 325 | 33 | 34.2 | 1 | 11 | 54.0 |
| | 19 | 330 | 55 | 32.9 | -1 | 05 | 18.0 | | 3 | 325 | 26 | 12.7 | -1 | 11 | 55.7 |
| | 20 | 330 | 50 | 19.4 | 1 | 05 | 32.4 | | 4 | 325 | 18 | 55.9 | 1 | 11 | 57.1 |
| | 21 | 330 | 44 | 57.0 | 1 | 05 | 46.7 | | 5 | 325 | 11 | 44.1 | 1 | 11 | 58.2 |
| | 22 | 330 | 39 | 25.8 | 1 | 06 | 00.8 | | 6 | 325 | 04 | 37.6 | 1 | 11 | 58.9 |
| | 23 | 330 | 33 | 46.0 | 1 | 06 | 14.7 | | 7 | 324 | 57 | 36.8 | 1 | 11 | 59.3 |
| | 24 | 330 | 27 | 57.8 | 1 | 06 | 28.4 | | 8 | 324 | 50 | 41.9 | 1 | 11 | 59.5 |
| | 25 | 330 | 22 | 01.3 | -1 | 06 | 41.8 | | 9 | 324 | 43 | 53.5 | -1 | 11 | 59.3 |
| | 26 | 330 | 15 | 56.8 | 1 | 06 | 55.1 | | 10 | 324 | 37 | 11.6 | 1 | 11 | 58.9 |
| | 27 | 330 | 09 | 44.4 | 1 | 07 | 08.2 | | 11 | 324 | 30 | 36.8 | 1 | 11 | 58.1 |
| | 28 | 330 | 03 | 24.5 | 1 | 07 | 21.0 | | 12 | 324 | 24 | 09.2 | 1 | 11 | 57.1 |
| | 29 | 329 | 56 | 57.1 | 1 | 07 | 33.6 | | 13 | 324 | 17 | 49.3 | 1 | 11 | 55.8 |
| | 30 | 329 | 50 | 22.7 | 1 | 07 | 46.0 | | 14 | 324 | 11 | 37.1 | 1 | 11 | 54.2 |
| | 31 | 329 | 43 | 41.5 | -1 | 07 | 58.1 | | 15 | 324 | 05 | 33.0 | -1 | 11 | 52.3 |
| Aug. | 1 | 329 | 36 | 53.8 | 1 | 08 | 10.0 | | 16 | 323 | 59 | 37.1 | 1 | 11 | 50.1 |
| | 2 | 329 | 29 | 59.8 | 1 | 08 | 21.6 | | 17 | 323 | 53 | 49.7 | 1 | 11 | 47.7 |
| | 3 | 329 | 22 | 59.8 | 1 | 08 | 32.9 | | 18 | 323 | 48 | 10.9 | 1 | 11 | 45.0 |
| | 4 | 329 | 15 | 54.1 | 1 | 08 | 44.0 | | 19 | 323 | 42 | 40.9 | 1 | 11 | 42.0 |
| | 5 | 329 | 08 | 43.0 | 1 | 08 | 54.8 | | 20 | 323 | 37 | 20.0 | 1 | 11 | 38.8 |
| | 6 | 329 | 01 | 26.8 | -1 | 09 | 05.4 | | 21 | 323 | 32 | 08.3 | -1 | 11 | 35.3 |
| | 7 | 328 | 54 | 05.8 | 1 | 09 | 15.7 | | 22 | 323 | 27 | 06.1 | 1 | 11 | 31.6 |
| | 8 | 328 | 46 | 40.3 | 1 | 09 | 25.7 | | 23 | 323 | 22 | 13.6 | 1 | 11 | 27.6 |
| | 9 | 328 | 39 | 10.6 | 1 | 09 | 35.4 | | 24 | 323 | 17 | 30.9 | 1 | 11 | 23.4 |
| | 10 | 328 | 31 | 37.1 | 1 | 09 | 44.8 | | 25 | 323 | 12 | 58.3 | 1 | 11 | 19.0 |
| | 11 | 328 | 24 | 00.1 | 1 | 09 | 53.9 | | 26 | 323 | 08 | 35.9 | 1 | 11 | 14.3 |
| | 12 | 328 | 16 | 19.9 | -1 | 10 | 02.7 | | 27 | 323 | 04 | 23.9 | -1 | 11 | 09.5 |
| | 13 | 328 | 08 | 37.0 | 1 | 10 | 11.3 | | 28 | 323 | 00 | 22.4 | 1 | 11 | 04.4 |
| | 14 | 328 | 00 | 51.7 | 1 | 10 | 19.5 | | 29 | 322 | 56 | 31.6 | 1 | 10 | 59.1 |
| | 15 | 327 | 53 | 04.4 | 1 | 10 | 27.4 | | 30 | 322 | 52 | 51.7 | 1 | 10 | 53.7 |
| | 16 | 327 | 45 | 15.5 | -1 | 10 | 35.0 | Oct. | 1 | 322 | 49 | 22.6 | -1 | 10 | 48.0 |

**JUPITER, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| Oct. | 1 | 322 | 49 | 22.6 | -1 | 10 | 48.0 | Nov. | 16 | 323 | 41 | 15.1 | -1 | 04 | 48.6 |
| | 2 | 322 | 46 | 04.6 | 1 | 10 | 42.2 | | 17 | 323 | 46 | 52.5 | 1 | 04 | 40.5 |
| | 3 | 322 | 42 | 57.8 | 1 | 10 | 36.2 | | 18 | 323 | 52 | 40.2 | 1 | 04 | 32.3 |
| | 4 | 322 | 40 | 02.3 | 1 | 10 | 30.1 | | 19 | 323 | 58 | 38.2 | 1 | 04 | 24.2 |
| | 5 | 322 | 37 | 18.2 | 1 | 10 | 23.8 | | 20 | 324 | 04 | 46.5 | 1 | 04 | 16.2 |
| | 6 | 322 | 34 | 45.7 | 1 | 10 | 17.4 | | 21 | 324 | 11 | 04.8 | 1 | 04 | 08.2 |
| | 7 | 322 | 32 | 24.9 | -1 | 10 | 10.8 | | 22 | 324 | 17 | 33.1 | -1 | 04 | 00.2 |
| | 8 | 322 | 30 | 15.9 | 1 | 10 | 04.0 | | 23 | 324 | 24 | 11.3 | 1 | 03 | 52.4 |
| | 9 | 322 | 28 | 18.8 | 1 | 09 | 57.2 | | 24 | 324 | 30 | 59.2 | 1 | 03 | 44.5 |
| | 10 | 322 | 26 | 33.7 | 1 | 09 | 50.2 | | 25 | 324 | 37 | 56.8 | 1 | 03 | 36.8 |
| | 11 | 322 | 25 | 00.6 | 1 | 09 | 43.1 | | 26 | 324 | 45 | 04.0 | 1 | 03 | 29.1 |
| | 12 | 322 | 23 | 39.5 | 1 | 09 | 35.8 | | 27 | 324 | 52 | 20.5 | 1 | 03 | 21.5 |
| | 13 | 322 | 22 | 30.6 | -1 | 09 | 28.5 | | 28 | 324 | 59 | 46.5 | -1 | 03 | 14.0 |
| | 14 | 322 | 21 | 33.6 | 1 | 09 | 21.0 | | 29 | 325 | 07 | 21.7 | 1 | 03 | 06.5 |
| | 15 | 322 | 20 | 48.7 | 1 | 09 | 13.4 | | 30 | 325 | 15 | 06.1 | 1 | 02 | 59.1 |
| | 16 | 322 | 20 | 15.8 | 1 | 09 | 05.8 | Dec. | 1 | 325 | 22 | 59.6 | 1 | 02 | 51.8 |
| | 17 | 322 | 19 | 54.9 | 1 | 08 | 58.0 | | 2 | 325 | 31 | 02.2 | 1 | 02 | 44.6 |
| | 18 | 322 | 19 | 46.1 | 1 | 08 | 50.2 | | 3 | 325 | 39 | 13.7 | 1 | 02 | 37.4 |
| | 19 | 322 | 19 | 49.4 | -1 | 08 | 42.2 | | 4 | 325 | 47 | 34.2 | -1 | 02 | 30.3 |
| | 20 | 322 | 20 | 04.7 | 1 | 08 | 34.2 | | 5 | 325 | 56 | 03.4 | 1 | 02 | 23.3 |
| | 21 | 322 | 20 | 32.1 | 1 | 08 | 26.1 | | 6 | 326 | 04 | 41.2 | 1 | 02 | 16.4 |
| | 22 | 322 | 21 | 11.6 | 1 | 08 | 18.0 | | 7 | 326 | 13 | 27.4 | 1 | 02 | 09.6 |
| | 23 | 322 | 22 | 03.2 | 1 | 08 | 09.8 | | 8 | 326 | 22 | 22.0 | 1 | 02 | 02.8 |
| | 24 | 322 | 23 | 06.8 | 1 | 08 | 01.6 | | 9 | 326 | 31 | 24.7 | 1 | 01 | 56.2 |
| | 25 | 322 | 24 | 22.4 | -1 | 07 | 53.3 | | 10 | 326 | 40 | 35.3 | -1 | 01 | 49.6 |
| | 26 | 322 | 25 | 50.0 | 1 | 07 | 44.9 | | 11 | 326 | 49 | 54.0 | 1 | 01 | 43.0 |
| | 27 | 322 | 27 | 29.5 | 1 | 07 | 36.5 | | 12 | 326 | 59 | 20.4 | 1 | 01 | 36.6 |
| | 28 | 322 | 29 | 20.9 | 1 | 07 | 28.2 | | 13 | 327 | 08 | 54.5 | 1 | 01 | 30.3 |
| | 29 | 322 | 31 | 24.2 | 1 | 07 | 19.7 | | 14 | 327 | 18 | 36.2 | 1 | 01 | 24.0 |
| | 30 | 322 | 33 | 39.3 | 1 | 07 | 11.3 | | 15 | 327 | 28 | 25.4 | 1 | 01 | 17.8 |
| | 31 | 322 | 36 | 06.1 | -1 | 07 | 02.8 | | 16 | 327 | 38 | 22.0 | -1 | 01 | 11.8 |
| Nov. | 1 | 322 | 38 | 44.7 | 1 | 06 | 54.4 | | 17 | 327 | 48 | 25.9 | 1 | 01 | 05.8 |
| | 2 | 322 | 41 | 35.0 | 1 | 06 | 45.9 | | 18 | 327 | 58 | 37.0 | 1 | 00 | 59.9 |
| | 3 | 322 | 44 | 36.9 | 1 | 06 | 37.5 | | 19 | 328 | 08 | 55.2 | 1 | 00 | 54.1 |
| | 4 | 322 | 47 | 50.6 | 1 | 06 | 29.0 | | 20 | 328 | 19 | 20.3 | 1 | 00 | 48.4 |
| | 5 | 322 | 51 | 15.8 | 1 | 06 | 20.5 | | 21 | 328 | 29 | 52.2 | 1 | 00 | 42.8 |
| | 6 | 322 | 54 | 52.7 | -1 | 06 | 12.1 | | 22 | 328 | 40 | 30.8 | -1 | 00 | 37.3 |
| | 7 | 322 | 58 | 41.0 | 1 | 06 | 03.7 | | 23 | 328 | 51 | 16.0 | 1 | 00 | 31.9 |
| | 8 | 323 | 02 | 40.8 | 1 | 05 | 55.2 | | 24 | 329 | 02 | 07.7 | 1 | 00 | 26.6 |
| | 9 | 323 | 06 | 51.8 | 1 | 05 | 46.8 | | 25 | 329 | 13 | 05.8 | 1 | 00 | 21.4 |
| | 10 | 323 | 11 | 14.0 | 1 | 05 | 38.4 | | 26 | 329 | 24 | 10.2 | 1 | 00 | 16.3 |
| | 11 | 323 | 15 | 47.2 | 1 | 05 | 30.1 | | 27 | 329 | 35 | 20.8 | 1 | 00 | 11.3 |
| | 12 | 323 | 20 | 31.3 | -1 | 05 | 21.7 | | 28 | 329 | 46 | 37.6 | -1 | 00 | 06.4 |
| | 13 | 323 | 25 | 26.3 | 1 | 05 | 13.4 | | 29 | 329 | 58 | 00.5 | 1 | 00 | 01.7 |
| | 14 | 323 | 30 | 31.9 | 1 | 05 | 05.1 | | 30 | 330 | 09 | 29.4 | 0 | 59 | 57.0 |
| | 15 | 323 | 35 | 48.3 | 1 | 04 | 56.9 | | 31 | 330 | 21 | 04.2 | 0 | 59 | 52.4 |
| | 16 | 323 | 41 | 15.1 | -1 | 04 | 48.6 | | 32 | 330 | 32 | 44.9 | -0 | 59 | 48.0 |

**JUPITER, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Jan. | 0 | 20 | 19 | 47.86 | -20 | 03 | 48.4 | 5.988 220 | 1.47 | 15.37 | 13 | 38 | 35 |
| | 1 | 20 | 20 | 44.58 | 20 | 00 | 44.5 | 5.993 967 | 1.47 | 15.36 | 13 | 35 | 35 |
| | 2 | 20 | 21 | 41.43 | 19 | 57 | 39.0 | 5.999 516 | 1.47 | 15.34 | 13 | 32 | 36 |
| | 3 | 20 | 22 | 38.39 | 19 | 54 | 31.9 | 6.004 865 | 1.46 | 15.33 | 13 | 29 | 37 |
| | 4 | 20 | 23 | 35.47 | 19 | 51 | 23.3 | 6.010 014 | 1.46 | 15.32 | 13 | 26 | 38 |
| | 5 | 20 | 24 | 32.66 | 19 | 48 | 13.1 | 6.014 962 | 1.46 | 15.31 | 13 | 23 | 39 |
| | 6 | 20 | 25 | 29.96 | -19 | 45 | 01.4 | 6.019 706 | 1.46 | 15.29 | 13 | 20 | 40 |
| | 7 | 20 | 26 | 27.35 | 19 | 41 | 48.1 | 6.024 248 | 1.46 | 15.28 | 13 | 17 | 41 |
| | 8 | 20 | 27 | 24.84 | 19 | 38 | 33.2 | 6.028 584 | 1.46 | 15.27 | 13 | 14 | 43 |
| | 9 | 20 | 28 | 22.43 | 19 | 35 | 16.9 | 6.032 715 | 1.46 | 15.26 | 13 | 11 | 44 |
| | 10 | 20 | 29 | 20.10 | 19 | 31 | 59.0 | 6.036 638 | 1.46 | 15.25 | 13 | 08 | 46 |
| | 11 | 20 | 30 | 17.85 | 19 | 28 | 39.7 | 6.040 353 | 1.46 | 15.24 | 13 | 05 | 47 |
| | 12 | 20 | 31 | 15.67 | -19 | 25 | 18.9 | 6.043 860 | 1.46 | 15.23 | 13 | 02 | 49 |
| | 13 | 20 | 32 | 13.56 | 19 | 21 | 56.8 | 6.047 157 | 1.45 | 15.22 | 12 | 59 | 51 |
| | 14 | 20 | 33 | 11.50 | 19 | 18 | 33.2 | 6.050 243 | 1.45 | 15.22 | 12 | 56 | 52 |
| | 15 | 20 | 34 | 09.48 | 19 | 15 | 08.3 | 6.053 118 | 1.45 | 15.21 | 12 | 53 | 54 |
| | 16 | 20 | 35 | 07.51 | 19 | 11 | 42.1 | 6.055 782 | 1.45 | 15.20 | 12 | 50 | 56 |
| | 17 | 20 | 36 | 05.56 | 19 | 08 | 14.5 | 6.058 235 | 1.45 | 15.20 | 12 | 47 | 58 |
| | 18 | 20 | 37 | 03.65 | -19 | 04 | 45.7 | 6.060 476 | 1.45 | 15.19 | 12 | 44 | 60 |
| | 19 | 20 | 38 | 01.75 | 19 | 01 | 15.5 | 6.062 505 | 1.45 | 15.19 | 12 | 42 | 02 |
| | 20 | 20 | 38 | 59.87 | 18 | 57 | 44.0 | 6.064 322 | 1.45 | 15.18 | 12 | 39 | 04 |
| | 21 | 20 | 39 | 58.01 | 18 | 54 | 11.3 | 6.065 928 | 1.45 | 15.18 | 12 | 36 | 06 |
| | 22 | 20 | 40 | 56.15 | 18 | 50 | 37.4 | 6.067 321 | 1.45 | 15.17 | 12 | 33 | 08 |
| | 23 | 20 | 41 | 54.30 | 18 | 47 | 02.2 | 6.068 503 | 1.45 | 15.17 | 12 | 30 | 10 |
| | 24 | 20 | 42 | 52.44 | -18 | 43 | 25.9 | 6.069 474 | 1.45 | 15.17 | 12 | 27 | 12 |
| | 25 | 20 | 43 | 50.57 | 18 | 39 | 48.4 | 6.070 233 | 1.45 | 15.17 | 12 | 24 | 13 |
| | 26 | 20 | 44 | 48.69 | 18 | 36 | 09.8 | 6.070 781 | 1.45 | 15.16 | 12 | 21 | 15 |
| | 27 | 20 | 45 | 46.80 | 18 | 32 | 30.2 | 6.071 118 | 1.45 | 15.16 | 12 | 18 | 17 |
| | 28 | 20 | 46 | 44.88 | 18 | 28 | 49.5 | 6.071 244 | 1.45 | 15.16 | 12 | 15 | 19 |
| | 29 | 20 | 47 | 42.91 | 18 | 25 | 08.4 | 6.071 159 | 1.45 | 15.16 | 12 | 12 | 21 |
| | 30 | 20 | 48 | 40.88 | -18 | 21 | 25.3 | 6.070 864 | 1.45 | 15.16 | 12 | 09 | 23 |
| | 31 | 20 | 49 | 38.84 | 18 | 17 | 41.3 | 6.070 359 | 1.45 | 15.17 | 12 | 06 | 24 |
| Feb. | 1 | 20 | 50 | 36.75 | 18 | 13 | 56.5 | 6.069 643 | 1.45 | 15.17 | 12 | 03 | 26 |
| | 2 | 20 | 51 | 34.62 | 18 | 10 | 10.8 | 6.068 717 | 1.45 | 15.17 | 12 | 00 | 28 |
| | 3 | 20 | 52 | 32.42 | 18 | 06 | 24.2 | 6.067 580 | 1.45 | 15.17 | 11 | 57 | 29 |
| | 4 | 20 | 53 | 30.17 | 18 | 02 | 36.6 | 6.066 232 | 1.45 | 15.18 | 11 | 54 | 31 |
| | 5 | 20 | 54 | 27.87 | -17 | 58 | 48.1 | 6.064 674 | 1.45 | 15.18 | 11 | 51 | 32 |
| | 6 | 20 | 55 | 25.49 | 17 | 54 | 58.8 | 6.062 904 | 1.45 | 15.18 | 11 | 48 | 34 |
| | 7 | 20 | 56 | 23.05 | 17 | 51 | 08.6 | 6.060 924 | 1.45 | 15.19 | 11 | 45 | 35 |
| | 8 | 20 | 57 | 20.52 | 17 | 47 | 17.7 | 6.058 733 | 1.45 | 15.19 | 11 | 42 | 36 |
| | 9 | 20 | 58 | 17.91 | 17 | 43 | 26.0 | 6.056 331 | 1.45 | 15.20 | 11 | 39 | 38 |
| | 10 | 20 | 59 | 15.21 | 17 | 39 | 33.6 | 6.053 719 | 1.45 | 15.21 | 11 | 36 | 39 |
| | 11 | 21 | 00 | 12.41 | -17 | 35 | 40.6 | 6.050 896 | 1.45 | 15.21 | 11 | 33 | 40 |
| | 12 | 21 | 01 | 09.50 | 17 | 31 | 46.9 | 6.047 864 | 1.45 | 15.22 | 11 | 30 | 40 |
| | 13 | 21 | 02 | 06.47 | 17 | 27 | 52.6 | 6.044 623 | 1.45 | 15.23 | 11 | 27 | 41 |
| | 14 | 21 | 03 | 03.33 | 17 | 23 | 57.7 | 6.041 174 | 1.46 | 15.24 | 11 | 24 | 42 |
| | 15 | 21 | 04 | 00.06 | -17 | 20 | 02.2 | 6.037 517 | 1.46 | 15.25 | 11 | 21 | 42 |

**JUPITER, 2021**
RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Feb. | 15 | 21 | 04 | 00.06 | -17 | 20 | 02.2 | 6.037 517 | 1.46 | 15.25 | 11 | 21 | 42 |
| | 16 | 21 | 04 | 56.67 | 17 | 16 | 06.2 | 6.033 654 | 1.46 | 15.26 | 11 | 18 | 43 |
| | 17 | 21 | 05 | 53.15 | 17 | 12 | 09.7 | 6.029 585 | 1.46 | 15.27 | 11 | 15 | 43 |
| | 18 | 21 | 06 | 49.48 | 17 | 08 | 12.8 | 6.025 312 | 1.46 | 15.28 | 11 | 12 | 43 |
| | 19 | 21 | 07 | 45.68 | 17 | 04 | 15.4 | 6.020 836 | 1.46 | 15.29 | 11 | 09 | 43 |
| | 20 | 21 | 08 | 41.74 | 17 | 00 | 17.6 | 6.016 157 | 1.46 | 15.30 | 11 | 06 | 43 |
| | 21 | 21 | 09 | 37.64 | -16 | 56 | 19.4 | 6.011 276 | 1.46 | 15.31 | 11 | 03 | 42 |
| | 22 | 21 | 10 | 33.39 | 16 | 52 | 20.9 | 6.006 196 | 1.46 | 15.33 | 11 | 00 | 42 |
| | 23 | 21 | 11 | 28.97 | 16 | 48 | 22.2 | 6.000 917 | 1.47 | 15.34 | 10 | 57 | 41 |
| | 24 | 21 | 12 | 24.39 | 16 | 44 | 23.2 | 5.995 440 | 1.47 | 15.36 | 10 | 54 | 40 |
| | 25 | 21 | 13 | 19.64 | 16 | 40 | 24.1 | 5.989 766 | 1.47 | 15.37 | 10 | 51 | 39 |
| | 26 | 21 | 14 | 14.71 | 16 | 36 | 24.7 | 5.983 897 | 1.47 | 15.38 | 10 | 48 | 38 |
| | 27 | 21 | 15 | 09.59 | -16 | 32 | 25.3 | 5.977 833 | 1.47 | 15.40 | 10 | 45 | 37 |
| | 28 | 21 | 16 | 04.29 | 16 | 28 | 25.7 | 5.971 576 | 1.47 | 15.42 | 10 | 42 | 35 |
| Mar. | 1 | 21 | 16 | 58.80 | 16 | 24 | 26.0 | 5.965 126 | 1.47 | 15.43 | 10 | 39 | 34 |
| | 2 | 21 | 17 | 53.12 | 16 | 20 | 26.3 | 5.958 485 | 1.48 | 15.45 | 10 | 36 | 32 |
| | 3 | 21 | 18 | 47.24 | 16 | 16 | 26.5 | 5.951 653 | 1.48 | 15.47 | 10 | 33 | 30 |
| | 4 | 21 | 19 | 41.17 | 16 | 12 | 26.7 | 5.944 631 | 1.48 | 15.49 | 10 | 30 | 27 |
| | 5 | 21 | 20 | 34.90 | -16 | 08 | 27.0 | 5.937 420 | 1.48 | 15.51 | 10 | 27 | 25 |
| | 6 | 21 | 21 | 28.41 | 16 | 04 | 27.3 | 5.930 021 | 1.48 | 15.52 | 10 | 24 | 22 |
| | 7 | 21 | 22 | 21.72 | 16 | 00 | 27.7 | 5.922 434 | 1.48 | 15.54 | 10 | 21 | 19 |
| | 8 | 21 | 23 | 14.80 | 15 | 56 | 28.3 | 5.914 660 | 1.49 | 15.56 | 10 | 18 | 16 |
| | 9 | 21 | 24 | 07.66 | 15 | 52 | 29.2 | 5.906 702 | 1.49 | 15.59 | 10 | 15 | 12 |
| | 10 | 21 | 25 | 00.28 | 15 | 48 | 30.3 | 5.898 559 | 1.49 | 15.61 | 10 | 12 | 09 |
| | 11 | 21 | 25 | 52.66 | -15 | 44 | 31.8 | 5.890 233 | 1.49 | 15.63 | 10 | 09 | 05 |
| | 12 | 21 | 26 | 44.79 | 15 | 40 | 33.5 | 5.881 726 | 1.50 | 15.65 | 10 | 06 | 01 |
| | 13 | 21 | 27 | 36.67 | 15 | 36 | 35.7 | 5.873 039 | 1.50 | 15.68 | 10 | 02 | 56 |
| | 14 | 21 | 28 | 28.29 | 15 | 32 | 38.3 | 5.864 174 | 1.50 | 15.70 | 9 | 59 | 52 |
| | 15 | 21 | 29 | 19.65 | 15 | 28 | 41.3 | 5.855 133 | 1.50 | 15.72 | 9 | 56 | 47 |
| | 16 | 21 | 30 | 10.75 | 15 | 24 | 44.8 | 5.845 917 | 1.50 | 15.75 | 9 | 53 | 42 |
| | 17 | 21 | 31 | 01.57 | -15 | 20 | 48.9 | 5.836 528 | 1.51 | 15.77 | 9 | 50 | 36 |
| | 18 | 21 | 31 | 52.12 | 15 | 16 | 53.5 | 5.826 969 | 1.51 | 15.80 | 9 | 47 | 30 |
| | 19 | 21 | 32 | 42.39 | 15 | 12 | 58.8 | 5.817 240 | 1.51 | 15.83 | 9 | 44 | 24 |
| | 20 | 21 | 33 | 32.37 | 15 | 09 | 04.7 | 5.807 345 | 1.51 | 15.85 | 9 | 41 | 18 |
| | 21 | 21 | 34 | 22.07 | 15 | 05 | 11.3 | 5.797 285 | 1.52 | 15.88 | 9 | 38 | 12 |
| | 22 | 21 | 35 | 11.47 | 15 | 01 | 18.7 | 5.787 061 | 1.52 | 15.91 | 9 | 35 | 05 |
| | 23 | 21 | 36 | 00.56 | -14 | 57 | 26.9 | 5.776 677 | 1.52 | 15.94 | 9 | 31 | 58 |
| | 24 | 21 | 36 | 49.36 | 14 | 53 | 36.0 | 5.766 134 | 1.53 | 15.97 | 9 | 28 | 50 |
| | 25 | 21 | 37 | 37.84 | 14 | 49 | 45.9 | 5.755 435 | 1.53 | 16.00 | 9 | 25 | 42 |
| | 26 | 21 | 38 | 26.00 | 14 | 45 | 56.8 | 5.744 580 | 1.53 | 16.03 | 9 | 22 | 34 |
| | 27 | 21 | 39 | 13.84 | 14 | 42 | 08.7 | 5.733 572 | 1.53 | 16.06 | 9 | 19 | 26 |
| | 28 | 21 | 40 | 01.35 | 14 | 38 | 21.5 | 5.722 414 | 1.54 | 16.09 | 9 | 16 | 17 |
| | 29 | 21 | 40 | 48.54 | -14 | 34 | 35.4 | 5.711 106 | 1.54 | 16.12 | 9 | 13 | 08 |
| | 30 | 21 | 41 | 35.39 | 14 | 30 | 50.4 | 5.699 651 | 1.54 | 16.15 | 9 | 09 | 59 |
| | 31 | 21 | 42 | 21.91 | 14 | 27 | 06.4 | 5.688 050 | 1.55 | 16.18 | 9 | 06 | 49 |
| Apr. | 1 | 21 | 43 | 08.10 | 14 | 23 | 23.6 | 5.676 304 | 1.55 | 16.22 | 9 | 03 | 39 |
| | 2 | 21 | 43 | 53.94 | -14 | 19 | 41.9 | 5.664 416 | 1.55 | 16.25 | 9 | 00 | 28 |

**JUPITER, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Apr. | 1 | 21 | 43 | 08.10 | -14 | 23 | 23.6 | 5.676 304 | 1.55 | 16.22 | 9 | 03 | 39 |
| | 2 | 21 | 43 | 53.94 | 14 | 19 | 41.9 | 5.664 416 | 1.55 | 16.25 | 9 | 00 | 28 |
| | 3 | 21 | 44 | 39.44 | 14 | 16 | 01.5 | 5.652 387 | 1.56 | 16.29 | 8 | 57 | 17 |
| | 4 | 21 | 45 | 24.58 | 14 | 12 | 22.4 | 5.640 218 | 1.56 | 16.32 | 8 | 54 | 06 |
| | 5 | 21 | 46 | 09.35 | 14 | 08 | 44.6 | 5.627 913 | 1.56 | 16.36 | 8 | 50 | 55 |
| | 6 | 21 | 46 | 53.76 | 14 | 05 | 08.2 | 5.615 471 | 1.57 | 16.39 | 8 | 47 | 43 |
| | 7 | 21 | 47 | 37.78 | -14 | 01 | 33.3 | 5.602 897 | 1.57 | 16.43 | 8 | 44 | 31 |
| | 8 | 21 | 48 | 21.42 | 13 | 57 | 59.9 | 5.590 191 | 1.57 | 16.47 | 8 | 41 | 18 |
| | 9 | 21 | 49 | 04.67 | 13 | 54 | 28.0 | 5.577 357 | 1.58 | 16.51 | 8 | 38 | 05 |
| | 10 | 21 | 49 | 47.53 | 13 | 50 | 57.7 | 5.564 396 | 1.58 | 16.54 | 8 | 34 | 52 |
| | 11 | 21 | 50 | 29.99 | 13 | 47 | 29.0 | 5.551 311 | 1.58 | 16.58 | 8 | 31 | 38 |
| | 12 | 21 | 51 | 12.04 | 13 | 44 | 02.0 | 5.538 105 | 1.59 | 16.62 | 8 | 28 | 24 |
| | 13 | 21 | 51 | 53.68 | -13 | 40 | 36.6 | 5.524 781 | 1.59 | 16.66 | 8 | 25 | 09 |
| | 14 | 21 | 52 | 34.90 | 13 | 37 | 13.1 | 5.511 340 | 1.60 | 16.70 | 8 | 21 | 54 |
| | 15 | 21 | 53 | 15.71 | 13 | 33 | 51.3 | 5.497 786 | 1.60 | 16.74 | 8 | 18 | 39 |
| | 16 | 21 | 53 | 56.09 | 13 | 30 | 31.4 | 5.484 122 | 1.60 | 16.79 | 8 | 15 | 23 |
| | 17 | 21 | 54 | 36.03 | 13 | 27 | 13.4 | 5.470 350 | 1.61 | 16.83 | 8 | 12 | 06 |
| | 18 | 21 | 55 | 15.54 | 13 | 23 | 57.4 | 5.456 473 | 1.61 | 16.87 | 8 | 08 | 50 |
| | 19 | 21 | 55 | 54.61 | -13 | 20 | 43.3 | 5.442 495 | 1.62 | 16.92 | 8 | 05 | 32 |
| | 20 | 21 | 56 | 33.23 | 13 | 17 | 31.4 | 5.428 417 | 1.62 | 16.96 | 8 | 02 | 15 |
| | 21 | 21 | 57 | 11.39 | 13 | 14 | 21.5 | 5.414 243 | 1.62 | 17.00 | 7 | 58 | 57 |
| | 22 | 21 | 57 | 49.09 | 13 | 11 | 13.8 | 5.399 975 | 1.63 | 17.05 | 7 | 55 | 38 |
| | 23 | 21 | 58 | 26.33 | 13 | 08 | 08.3 | 5.385 617 | 1.63 | 17.09 | 7 | 52 | 19 |
| | 24 | 21 | 59 | 03.09 | 13 | 05 | 05.0 | 5.371 171 | 1.64 | 17.14 | 7 | 48 | 60 |
| | 25 | 21 | 59 | 39.38 | -13 | 02 | 04.0 | 5.356 639 | 1.64 | 17.19 | 7 | 45 | 40 |
| | 26 | 22 | 00 | 15.19 | 12 | 59 | 05.3 | 5.342 026 | 1.65 | 17.23 | 7 | 42 | 19 |
| | 27 | 22 | 00 | 50.52 | 12 | 56 | 08.9 | 5.327 332 | 1.65 | 17.28 | 7 | 38 | 58 |
| | 28 | 22 | 01 | 25.36 | 12 | 53 | 14.8 | 5.312 560 | 1.66 | 17.33 | 7 | 35 | 37 |
| | 29 | 22 | 01 | 59.72 | 12 | 50 | 23.2 | 5.297 713 | 1.66 | 17.38 | 7 | 32 | 15 |
| | 30 | 22 | 02 | 33.58 | 12 | 47 | 34.0 | 5.282 793 | 1.66 | 17.43 | 7 | 28 | 53 |
| May | 1 | 22 | 03 | 06.94 | -12 | 44 | 47.4 | 5.267 803 | 1.67 | 17.48 | 7 | 25 | 30 |
| | 2 | 22 | 03 | 39.79 | 12 | 42 | 03.3 | 5.252 745 | 1.67 | 17.53 | 7 | 22 | 07 |
| | 3 | 22 | 04 | 12.12 | 12 | 39 | 21.9 | 5.237 622 | 1.68 | 17.58 | 7 | 18 | 43 |
| | 4 | 22 | 04 | 43.93 | 12 | 36 | 43.1 | 5.222 437 | 1.68 | 17.63 | 7 | 15 | 18 |
| | 5 | 22 | 05 | 15.20 | 12 | 34 | 07.1 | 5.207 193 | 1.69 | 17.68 | 7 | 11 | 53 |
| | 6 | 22 | 05 | 45.92 | 12 | 31 | 33.9 | 5.191 893 | 1.69 | 17.73 | 7 | 08 | 28 |
| | 7 | 22 | 06 | 16.11 | -12 | 29 | 03.5 | 5.176 539 | 1.70 | 17.78 | 7 | 05 | 02 |
| | 8 | 22 | 06 | 45.74 | 12 | 26 | 36.0 | 5.161 136 | 1.70 | 17.84 | 7 | 01 | 35 |
| | 9 | 22 | 07 | 14.81 | 12 | 24 | 11.4 | 5.145 687 | 1.71 | 17.89 | 6 | 58 | 08 |
| | 10 | 22 | 07 | 43.33 | 12 | 21 | 49.7 | 5.130 195 | 1.71 | 17.94 | 6 | 54 | 40 |
| | 11 | 22 | 08 | 11.27 | 12 | 19 | 31.0 | 5.114 663 | 1.72 | 18.00 | 6 | 51 | 12 |
| | 12 | 22 | 08 | 38.64 | 12 | 17 | 15.4 | 5.099 096 | 1.72 | 18.05 | 6 | 47 | 43 |
| | 13 | 22 | 09 | 05.44 | -12 | 15 | 02.9 | 5.083 496 | 1.73 | 18.11 | 6 | 44 | 14 |
| | 14 | 22 | 09 | 31.65 | 12 | 12 | 53.5 | 5.067 867 | 1.74 | 18.17 | 6 | 40 | 44 |
| | 15 | 22 | 09 | 57.27 | 12 | 10 | 47.3 | 5.052 214 | 1.74 | 18.22 | 6 | 37 | 13 |
| | 16 | 22 | 10 | 22.29 | 12 | 08 | 44.3 | 5.036 539 | 1.75 | 18.28 | 6 | 33 | 42 |
| | 17 | 22 | 10 | 46.71 | -12 | 06 | 44.7 | 5.020 847 | 1.75 | 18.34 | 6 | 30 | 10 |

**JUPITER, 2021**
RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| May | 17 | 22 | 10 | 46.71 | -12 | 06 | 44.7 | 5.020 847 | 1.75 | 18.34 | 6 | 30 | 10 |
| | 18 | 22 | 11 | 10.53 | 12 | 04 | 48.3 | 5.005 141 | 1.76 | 18.39 | 6 | 26 | 38 |
| | 19 | 22 | 11 | 33.72 | 12 | 02 | 55.4 | 4.989 424 | 1.76 | 18.45 | 6 | 23 | 05 |
| | 20 | 22 | 11 | 56.30 | 12 | 01 | 05.8 | 4.973 701 | 1.77 | 18.51 | 6 | 19 | 31 |
| | 21 | 22 | 12 | 18.26 | 11 | 59 | 19.7 | 4.957 974 | 1.77 | 18.57 | 6 | 15 | 57 |
| | 22 | 22 | 12 | 39.58 | 11 | 57 | 37.0 | 4.942 249 | 1.78 | 18.63 | 6 | 12 | 22 |
| | 23 | 22 | 13 | 00.28 | -11 | 55 | 57.9 | 4.926 527 | 1.79 | 18.69 | 6 | 08 | 47 |
| | 24 | 22 | 13 | 20.34 | 11 | 54 | 22.2 | 4.910 813 | 1.79 | 18.75 | 6 | 05 | 10 |
| | 25 | 22 | 13 | 39.76 | 11 | 52 | 50.1 | 4.895 109 | 1.80 | 18.81 | 6 | 01 | 34 |
| | 26 | 22 | 13 | 58.55 | 11 | 51 | 21.6 | 4.879 419 | 1.80 | 18.87 | 5 | 57 | 56 |
| | 27 | 22 | 14 | 16.69 | 11 | 49 | 56.6 | 4.863 747 | 1.81 | 18.93 | 5 | 54 | 18 |
| | 28 | 22 | 14 | 34.19 | 11 | 48 | 35.3 | 4.848 095 | 1.81 | 18.99 | 5 | 50 | 40 |
| | 29 | 22 | 14 | 51.02 | -11 | 47 | 17.7 | 4.832 467 | 1.82 | 19.05 | 5 | 47 | 00 |
| | 30 | 22 | 15 | 07.20 | 11 | 46 | 03.9 | 4.816 867 | 1.83 | 19.11 | 5 | 43 | 20 |
| | 31 | 22 | 15 | 22.69 | 11 | 44 | 53.9 | 4.801 297 | 1.83 | 19.17 | 5 | 39 | 40 |
| June | 1 | 22 | 15 | 37.51 | 11 | 43 | 47.7 | 4.785 761 | 1.84 | 19.24 | 5 | 35 | 58 |
| | 2 | 22 | 15 | 51.65 | 11 | 42 | 45.3 | 4.770 264 | 1.84 | 19.30 | 5 | 32 | 16 |
| | 3 | 22 | 16 | 05.09 | 11 | 41 | 46.8 | 4.754 809 | 1.85 | 19.36 | 5 | 28 | 34 |
| | 4 | 22 | 16 | 17.84 | -11 | 40 | 52.3 | 4.739 400 | 1.86 | 19.42 | 5 | 24 | 50 |
| | 5 | 22 | 16 | 29.90 | 11 | 40 | 01.7 | 4.724 042 | 1.86 | 19.49 | 5 | 21 | 06 |
| | 6 | 22 | 16 | 41.26 | 11 | 39 | 15.0 | 4.708 739 | 1.87 | 19.55 | 5 | 17 | 21 |
| | 7 | 22 | 16 | 51.91 | 11 | 38 | 32.3 | 4.693 494 | 1.87 | 19.61 | 5 | 13 | 36 |
| | 8 | 22 | 17 | 01.85 | 11 | 37 | 53.7 | 4.678 312 | 1.88 | 19.68 | 5 | 09 | 50 |
| | 9 | 22 | 17 | 11.09 | 11 | 37 | 19.0 | 4.663 198 | 1.89 | 19.74 | 5 | 06 | 03 |
| | 10 | 22 | 17 | 19.61 | -11 | 36 | 48.5 | 4.648 155 | 1.89 | 19.81 | 5 | 02 | 15 |
| | 11 | 22 | 17 | 27.41 | 11 | 36 | 22.0 | 4.633 189 | 1.90 | 19.87 | 4 | 58 | 27 |
| | 12 | 22 | 17 | 34.49 | 11 | 35 | 59.7 | 4.618 303 | 1.90 | 19.93 | 4 | 54 | 38 |
| | 13 | 22 | 17 | 40.84 | 11 | 35 | 41.4 | 4.603 502 | 1.91 | 20.00 | 4 | 50 | 48 |
| | 14 | 22 | 17 | 46.47 | 11 | 35 | 27.4 | 4.588 791 | 1.92 | 20.06 | 4 | 46 | 58 |
| | 15 | 22 | 17 | 51.37 | 11 | 35 | 17.5 | 4.574 173 | 1.92 | 20.13 | 4 | 43 | 07 |
| | 16 | 22 | 17 | 55.53 | -11 | 35 | 11.7 | 4.559 653 | 1.93 | 20.19 | 4 | 39 | 15 |
| | 17 | 22 | 17 | 58.96 | 11 | 35 | 10.2 | 4.545 235 | 1.93 | 20.25 | 4 | 35 | 22 |
| | 18 | 22 | 18 | 01.66 | 11 | 35 | 12.8 | 4.530 924 | 1.94 | 20.32 | 4 | 31 | 29 |
| | 19 | 22 | 18 | 03.62 | 11 | 35 | 19.6 | 4.516 723 | 1.95 | 20.38 | 4 | 27 | 35 |
| | 20 | 22 | 18 | 04.85 | 11 | 35 | 30.5 | 4.502 638 | 1.95 | 20.45 | 4 | 23 | 40 |
| | 21 | 22 | 18 | 05.35 | 11 | 35 | 45.5 | 4.488 670 | 1.96 | 20.51 | 4 | 19 | 44 |
| | 22 | 22 | 18 | 05.13 | -11 | 36 | 04.7 | 4.474 825 | 1.97 | 20.57 | 4 | 15 | 48 |
| | 23 | 22 | 18 | 04.18 | 11 | 36 | 27.9 | 4.461 106 | 1.97 | 20.64 | 4 | 11 | 51 |
| | 24 | 22 | 18 | 02.50 | 11 | 36 | 55.3 | 4.447 517 | 1.98 | 20.70 | 4 | 07 | 53 |
| | 25 | 22 | 18 | 00.09 | 11 | 37 | 26.8 | 4.434 062 | 1.98 | 20.76 | 4 | 03 | 55 |
| | 26 | 22 | 17 | 56.95 | 11 | 38 | 02.4 | 4.420 745 | 1.99 | 20.82 | 3 | 59 | 56 |
| | 27 | 22 | 17 | 53.07 | 11 | 38 | 42.1 | 4.407 568 | 2.00 | 20.89 | 3 | 55 | 56 |
| | 28 | 22 | 17 | 48.46 | -11 | 39 | 26.0 | 4.394 538 | 2.00 | 20.95 | 3 | 51 | 55 |
| | 29 | 22 | 17 | 43.12 | 11 | 40 | 13.9 | 4.381 656 | 2.01 | 21.01 | 3 | 47 | 54 |
| | 30 | 22 | 17 | 37.04 | 11 | 41 | 05.9 | 4.368 929 | 2.01 | 21.07 | 3 | 43 | 52 |
| July | 1 | 22 | 17 | 30.23 | 11 | 42 | 02.0 | 4.356 359 | 2.02 | 21.13 | 3 | 39 | 49 |
| | 2 | 22 | 17 | 22.70 | -11 | 43 | 02.1 | 4.343 952 | 2.02 | 21.19 | 3 | 35 | 45 |

**JUPITER, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| July | 1 | 22 | 17 | 30.23 | -11 | 42 | 02.0 | 4.356 359 | 2.02 | 21.13 | 3 | 39 | 49 |
| | 2 | 22 | 17 | 22.70 | 11 | 43 | 02.1 | 4.343 952 | 2.02 | 21.19 | 3 | 35 | 45 |
| | 3 | 22 | 17 | 14.44 | 11 | 44 | 06.2 | 4.331 712 | 2.03 | 21.25 | 3 | 31 | 41 |
| | 4 | 22 | 17 | 05.46 | 11 | 45 | 14.3 | 4.319 642 | 2.04 | 21.31 | 3 | 27 | 36 |
| | 5 | 22 | 16 | 55.76 | 11 | 46 | 26.3 | 4.307 749 | 2.04 | 21.37 | 3 | 23 | 31 |
| | 6 | 22 | 16 | 45.35 | 11 | 47 | 42.2 | 4.296 035 | 2.05 | 21.43 | 3 | 19 | 24 |
| | 7 | 22 | 16 | 34.24 | -11 | 49 | 01.9 | 4.284 506 | 2.05 | 21.49 | 3 | 15 | 17 |
| | 8 | 22 | 16 | 22.42 | 11 | 50 | 25.5 | 4.273 165 | 2.06 | 21.54 | 3 | 11 | 09 |
| | 9 | 22 | 16 | 09.91 | 11 | 51 | 52.9 | 4.262 018 | 2.06 | 21.60 | 3 | 07 | 01 |
| | 10 | 22 | 15 | 56.70 | 11 | 53 | 24.0 | 4.251 068 | 2.07 | 21.66 | 3 | 02 | 52 |
| | 11 | 22 | 15 | 42.81 | 11 | 54 | 58.8 | 4.240 319 | 2.07 | 21.71 | 2 | 58 | 42 |
| | 12 | 22 | 15 | 28.24 | 11 | 56 | 37.3 | 4.229 777 | 2.08 | 21.76 | 2 | 54 | 32 |
| | 13 | 22 | 15 | 13.00 | -11 | 58 | 19.3 | 4.219 444 | 2.08 | 21.82 | 2 | 50 | 20 |
| | 14 | 22 | 14 | 57.10 | 12 | 00 | 04.9 | 4.209 325 | 2.09 | 21.87 | 2 | 46 | 09 |
| | 15 | 22 | 14 | 40.55 | 12 | 01 | 53.9 | 4.199 424 | 2.09 | 21.92 | 2 | 41 | 56 |
| | 16 | 22 | 14 | 23.36 | 12 | 03 | 46.2 | 4.189 744 | 2.10 | 21.97 | 2 | 37 | 43 |
| | 17 | 22 | 14 | 05.54 | 12 | 05 | 41.8 | 4.180 289 | 2.10 | 22.02 | 2 | 33 | 29 |
| | 18 | 22 | 13 | 47.10 | 12 | 07 | 40.6 | 4.171 062 | 2.11 | 22.07 | 2 | 29 | 15 |
| | 19 | 22 | 13 | 28.06 | -12 | 09 | 42.5 | 4.162 067 | 2.11 | 22.12 | 2 | 25 | 00 |
| | 20 | 22 | 13 | 08.43 | 12 | 11 | 47.4 | 4.153 306 | 2.12 | 22.17 | 2 | 20 | 45 |
| | 21 | 22 | 12 | 48.22 | 12 | 13 | 55.3 | 4.144 784 | 2.12 | 22.21 | 2 | 16 | 29 |
| | 22 | 22 | 12 | 27.44 | 12 | 16 | 06.0 | 4.136 502 | 2.13 | 22.26 | 2 | 12 | 12 |
| | 23 | 22 | 12 | 06.11 | 12 | 18 | 19.4 | 4.128 463 | 2.13 | 22.30 | 2 | 07 | 55 |
| | 24 | 22 | 11 | 44.23 | 12 | 20 | 35.7 | 4.120 671 | 2.13 | 22.34 | 2 | 03 | 37 |
| | 25 | 22 | 11 | 21.80 | -12 | 22 | 54.5 | 4.113 128 | 2.14 | 22.38 | 1 | 59 | 19 |
| | 26 | 22 | 10 | 58.86 | 12 | 25 | 15.9 | 4.105 837 | 2.14 | 22.42 | 1 | 55 | 00 |
| | 27 | 22 | 10 | 35.40 | 12 | 27 | 39.8 | 4.098 802 | 2.15 | 22.46 | 1 | 50 | 41 |
| | 28 | 22 | 10 | 11.44 | 12 | 30 | 06.0 | 4.092 025 | 2.15 | 22.50 | 1 | 46 | 21 |
| | 29 | 22 | 09 | 47.00 | 12 | 32 | 34.4 | 4.085 510 | 2.15 | 22.53 | 1 | 42 | 01 |
| | 30 | 22 | 09 | 22.09 | 12 | 35 | 05.0 | 4.079 258 | 2.16 | 22.57 | 1 | 37 | 40 |
| | 31 | 22 | 08 | 56.74 | -12 | 37 | 37.6 | 4.073 274 | 2.16 | 22.60 | 1 | 33 | 19 |
| Aug. | 1 | 22 | 08 | 30.95 | 12 | 40 | 12.2 | 4.067 560 | 2.16 | 22.63 | 1 | 28 | 57 |
| | 2 | 22 | 08 | 04.75 | 12 | 42 | 48.5 | 4.062 119 | 2.16 | 22.66 | 1 | 24 | 35 |
| | 3 | 22 | 07 | 38.15 | 12 | 45 | 26.6 | 4.056 953 | 2.17 | 22.69 | 1 | 20 | 13 |
| | 4 | 22 | 07 | 11.17 | 12 | 48 | 06.3 | 4.052 066 | 2.17 | 22.72 | 1 | 15 | 50 |
| | 5 | 22 | 06 | 43.83 | 12 | 50 | 47.4 | 4.047 459 | 2.17 | 22.75 | 1 | 11 | 27 |
| | 6 | 22 | 06 | 16.15 | -12 | 53 | 30.0 | 4.043 134 | 2.18 | 22.77 | 1 | 07 | 04 |
| | 7 | 22 | 05 | 48.14 | 12 | 56 | 13.8 | 4.039 095 | 2.18 | 22.79 | 1 | 02 | 40 |
| | 8 | 22 | 05 | 19.83 | 12 | 58 | 58.8 | 4.035 343 | 2.18 | 22.81 | 0 | 58 | 16 |
| | 9 | 22 | 04 | 51.23 | 13 | 01 | 44.7 | 4.031 881 | 2.18 | 22.83 | 0 | 53 | 52 |
| | 10 | 22 | 04 | 22.37 | 13 | 04 | 31.6 | 4.028 709 | 2.18 | 22.85 | 0 | 49 | 27 |
| | 11 | 22 | 03 | 53.27 | 13 | 07 | 19.2 | 4.025 829 | 2.18 | 22.87 | 0 | 45 | 02 |
| | 12 | 22 | 03 | 23.94 | -13 | 10 | 07.5 | 4.023 242 | 2.19 | 22.88 | 0 | 40 | 37 |
| | 13 | 22 | 02 | 54.43 | 13 | 12 | 56.2 | 4.020 951 | 2.19 | 22.90 | 0 | 36 | 12 |
| | 14 | 22 | 02 | 24.74 | 13 | 15 | 45.3 | 4.018 954 | 2.19 | 22.91 | 0 | 31 | 46 |
| | 15 | 22 | 01 | 54.91 | 13 | 18 | 34.5 | 4.017 254 | 2.19 | 22.92 | 0 | 27 | 21 |
| | 16 | 22 | 01 | 24.95 | -13 | 21 | 23.8 | 4.015 850 | 2.19 | 22.92 | 0 | 22 | 55 |

**JUPITER, 2021**
RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Aug. | 16 | 22 | 01 | 24.95 | -13 | 21 | 23.8 | 4.015 850 | 2.19 | 22.92 | 0 | 22 | 55 |
| | 17 | 22 | 00 | 54.90 | 13 | 24 | 13.1 | 4.014 743 | 2.19 | 22.93 | 0 | 18 | 29 |
| | 18 | 22 | 00 | 24.76 | 13 | 27 | 02.2 | 4.013 933 | 2.19 | 22.94 | 0 | 14 | 03 |
| | 19 | 21 | 59 | 54.57 | 13 | 29 | 51.0 | 4.013 420 | 2.19 | 22.94 | 0 | 09 | 37 |
| | 20 | 21 | 59 | 24.33 | 13 | 32 | 39.4 | 4.013 203 | 2.19 | 22.94 | 0 | 05 | 11 |
| | 21 | 21 | 58 | 54.08 | 13 | 35 | 27.4 | 4.013 284 | 2.19 | 22.94 | 0 | 00 | 45 |
| | 22 | 21 | 58 | 23.82 | -13 | 38 | 14.7 | 4.013 660 | 2.19 | 22.94 | 23 | 51 | 54 |
| | 23 | 21 | 57 | 53.58 | 13 | 41 | 01.2 | 4.014 334 | 2.19 | 22.93 | 23 | 47 | 28 |
| | 24 | 21 | 57 | 23.39 | 13 | 43 | 47.0 | 4.015 304 | 2.19 | 22.93 | 23 | 43 | 02 |
| | 25 | 21 | 56 | 53.27 | 13 | 46 | 31.7 | 4.016 570 | 2.19 | 22.92 | 23 | 38 | 36 |
| | 26 | 21 | 56 | 23.23 | 13 | 49 | 15.3 | 4.018 131 | 2.19 | 22.91 | 23 | 34 | 10 |
| | 27 | 21 | 55 | 53.30 | 13 | 51 | 57.7 | 4.019 989 | 2.19 | 22.90 | 23 | 29 | 45 |
| | 28 | 21 | 55 | 23.51 | -13 | 54 | 38.8 | 4.022 141 | 2.19 | 22.89 | 23 | 25 | 19 |
| | 29 | 21 | 54 | 53.87 | 13 | 57 | 18.4 | 4.024 588 | 2.19 | 22.87 | 23 | 20 | 54 |
| | 30 | 21 | 54 | 24.42 | 13 | 59 | 56.5 | 4.027 329 | 2.18 | 22.86 | 23 | 16 | 29 |
| | 31 | 21 | 53 | 55.16 | 14 | 02 | 32.9 | 4.030 363 | 2.18 | 22.84 | 23 | 12 | 04 |
| Sept. | 1 | 21 | 53 | 26.13 | 14 | 05 | 07.5 | 4.033 688 | 2.18 | 22.82 | 23 | 07 | 40 |
| | 2 | 21 | 52 | 57.35 | 14 | 07 | 40.3 | 4.037 305 | 2.18 | 22.80 | 23 | 03 | 16 |
| | 3 | 21 | 52 | 28.83 | -14 | 10 | 11.1 | 4.041 211 | 2.18 | 22.78 | 22 | 58 | 52 |
| | 4 | 21 | 52 | 00.59 | 14 | 12 | 39.9 | 4.045 406 | 2.17 | 22.76 | 22 | 54 | 28 |
| | 5 | 21 | 51 | 32.66 | 14 | 15 | 06.5 | 4.049 887 | 2.17 | 22.73 | 22 | 50 | 05 |
| | 6 | 21 | 51 | 05.06 | 14 | 17 | 30.8 | 4.054 654 | 2.17 | 22.70 | 22 | 45 | 42 |
| | 7 | 21 | 50 | 37.81 | 14 | 19 | 52.7 | 4.059 703 | 2.17 | 22.68 | 22 | 41 | 19 |
| | 8 | 21 | 50 | 10.94 | 14 | 22 | 12.2 | 4.065 033 | 2.16 | 22.65 | 22 | 36 | 57 |
| | 9 | 21 | 49 | 44.45 | -14 | 24 | 29.1 | 4.070 642 | 2.16 | 22.62 | 22 | 32 | 35 |
| | 10 | 21 | 49 | 18.39 | 14 | 26 | 43.3 | 4.076 526 | 2.16 | 22.58 | 22 | 28 | 13 |
| | 11 | 21 | 48 | 52.76 | 14 | 28 | 54.7 | 4.082 684 | 2.15 | 22.55 | 22 | 23 | 52 |
| | 12 | 21 | 48 | 27.59 | 14 | 31 | 03.2 | 4.089 111 | 2.15 | 22.51 | 22 | 19 | 32 |
| | 13 | 21 | 48 | 02.90 | 14 | 33 | 08.8 | 4.095 805 | 2.15 | 22.48 | 22 | 15 | 12 |
| | 14 | 21 | 47 | 38.70 | 14 | 35 | 11.3 | 4.102 764 | 2.14 | 22.44 | 22 | 10 | 52 |
| | 15 | 21 | 47 | 15.01 | -14 | 37 | 10.8 | 4.109 982 | 2.14 | 22.40 | 22 | 06 | 33 |
| | 16 | 21 | 46 | 51.84 | 14 | 39 | 07.2 | 4.117 458 | 2.14 | 22.36 | 22 | 02 | 15 |
| | 17 | 21 | 46 | 29.21 | 14 | 41 | 00.4 | 4.125 187 | 2.13 | 22.32 | 21 | 57 | 57 |
| | 18 | 21 | 46 | 07.12 | 14 | 42 | 50.3 | 4.133 167 | 2.13 | 22.27 | 21 | 53 | 40 |
| | 19 | 21 | 45 | 45.60 | 14 | 44 | 37.0 | 4.141 395 | 2.12 | 22.23 | 21 | 49 | 23 |
| | 20 | 21 | 45 | 24.66 | 14 | 46 | 20.3 | 4.149 866 | 2.12 | 22.18 | 21 | 45 | 07 |
| | 21 | 21 | 45 | 04.31 | -14 | 48 | 00.2 | 4.158 578 | 2.11 | 22.14 | 21 | 40 | 51 |
| | 22 | 21 | 44 | 44.56 | 14 | 49 | 36.6 | 4.167 528 | 2.11 | 22.09 | 21 | 36 | 36 |
| | 23 | 21 | 44 | 25.43 | 14 | 51 | 09.5 | 4.176 711 | 2.11 | 22.04 | 21 | 32 | 22 |
| | 24 | 21 | 44 | 06.94 | 14 | 52 | 38.8 | 4.186 126 | 2.10 | 21.99 | 21 | 28 | 08 |
| | 25 | 21 | 43 | 49.09 | 14 | 54 | 04.4 | 4.195 767 | 2.10 | 21.94 | 21 | 23 | 55 |
| | 26 | 21 | 43 | 31.89 | 14 | 55 | 26.5 | 4.205 633 | 2.09 | 21.89 | 21 | 19 | 43 |
| | 27 | 21 | 43 | 15.37 | -14 | 56 | 44.8 | 4.215 719 | 2.09 | 21.84 | 21 | 15 | 31 |
| | 28 | 21 | 42 | 59.52 | 14 | 57 | 59.4 | 4.226 023 | 2.08 | 21.78 | 21 | 11 | 20 |
| | 29 | 21 | 42 | 44.36 | 14 | 59 | 10.3 | 4.236 539 | 2.08 | 21.73 | 21 | 07 | 09 |
| | 30 | 21 | 42 | 29.90 | 15 | 00 | 17.4 | 4.247 265 | 2.07 | 21.68 | 21 | 02 | 60 |
| Oct. | 1 | 21 | 42 | 16.15 | -15 | 01 | 20.7 | 4.258 197 | 2.07 | 21.62 | 20 | 58 | 51 |

**JUPITER, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Oct. | 1 | 21 | 42 | 16.15 | -15 | 01 | 20.7 | 4.258 197 | 2.07 | 21.62 | 20 | 58 | 51 |
| | 2 | 21 | 42 | 03.11 | 15 | 02 | 20.2 | 4.269 330 | 2.06 | 21.56 | 20 | 54 | 43 |
| | 3 | 21 | 41 | 50.79 | 15 | 03 | 15.8 | 4.280 661 | 2.05 | 21.51 | 20 | 50 | 35 |
| | 4 | 21 | 41 | 39.21 | 15 | 04 | 07.5 | 4.292 186 | 2.05 | 21.45 | 20 | 46 | 28 |
| | 5 | 21 | 41 | 28.37 | 15 | 04 | 55.3 | 4.303 900 | 2.04 | 21.39 | 20 | 42 | 22 |
| | 6 | 21 | 41 | 18.27 | 15 | 05 | 39.1 | 4.315 800 | 2.04 | 21.33 | 20 | 38 | 17 |
| | 7 | 21 | 41 | 08.93 | -15 | 06 | 18.9 | 4.327 879 | 2.03 | 21.27 | 20 | 34 | 12 |
| | 8 | 21 | 41 | 00.36 | 15 | 06 | 54.7 | 4.340 135 | 2.03 | 21.21 | 20 | 30 | 09 |
| | 9 | 21 | 40 | 52.57 | 15 | 07 | 26.4 | 4.352 562 | 2.02 | 21.15 | 20 | 26 | 06 |
| | 10 | 21 | 40 | 45.55 | 15 | 07 | 54.1 | 4.365 155 | 2.01 | 21.09 | 20 | 22 | 03 |
| | 11 | 21 | 40 | 39.31 | 15 | 08 | 17.8 | 4.377 909 | 2.01 | 21.03 | 20 | 18 | 02 |
| | 12 | 21 | 40 | 33.86 | 15 | 08 | 37.4 | 4.390 819 | 2.00 | 20.97 | 20 | 14 | 01 |
| | 13 | 21 | 40 | 29.19 | -15 | 08 | 52.9 | 4.403 882 | 2.00 | 20.90 | 20 | 10 | 01 |
| | 14 | 21 | 40 | 25.31 | 15 | 09 | 04.5 | 4.417 091 | 1.99 | 20.84 | 20 | 06 | 02 |
| | 15 | 21 | 40 | 22.20 | 15 | 09 | 12.0 | 4.430 443 | 1.98 | 20.78 | 20 | 02 | 04 |
| | 16 | 21 | 40 | 19.88 | 15 | 09 | 15.5 | 4.443 932 | 1.98 | 20.72 | 19 | 58 | 06 |
| | 17 | 21 | 40 | 18.35 | 15 | 09 | 15.0 | 4.457 555 | 1.97 | 20.65 | 19 | 54 | 09 |
| | 18 | 21 | 40 | 17.60 | 15 | 09 | 10.4 | 4.471 307 | 1.97 | 20.59 | 19 | 50 | 13 |
| | 19 | 21 | 40 | 17.63 | -15 | 09 | 01.9 | 4.485 184 | 1.96 | 20.53 | 19 | 46 | 18 |
| | 20 | 21 | 40 | 18.45 | 15 | 08 | 49.3 | 4.499 180 | 1.95 | 20.46 | 19 | 42 | 24 |
| | 21 | 21 | 40 | 20.06 | 15 | 08 | 32.7 | 4.513 293 | 1.95 | 20.40 | 19 | 38 | 30 |
| | 22 | 21 | 40 | 22.45 | 15 | 08 | 12.1 | 4.527 518 | 1.94 | 20.33 | 19 | 34 | 37 |
| | 23 | 21 | 40 | 25.63 | 15 | 07 | 47.5 | 4.541 850 | 1.94 | 20.27 | 19 | 30 | 45 |
| | 24 | 21 | 40 | 29.60 | 15 | 07 | 18.9 | 4.556 286 | 1.93 | 20.21 | 19 | 26 | 54 |
| | 25 | 21 | 40 | 34.34 | -15 | 06 | 46.4 | 4.570 822 | 1.92 | 20.14 | 19 | 23 | 03 |
| | 26 | 21 | 40 | 39.87 | 15 | 06 | 09.9 | 4.585 452 | 1.92 | 20.08 | 19 | 19 | 13 |
| | 27 | 21 | 40 | 46.18 | 15 | 05 | 29.5 | 4.600 174 | 1.91 | 20.01 | 19 | 15 | 24 |
| | 28 | 21 | 40 | 53.26 | 15 | 04 | 45.1 | 4.614 982 | 1.91 | 19.95 | 19 | 11 | 36 |
| | 29 | 21 | 41 | 01.11 | 15 | 03 | 56.9 | 4.629 872 | 1.90 | 19.88 | 19 | 07 | 49 |
| | 30 | 21 | 41 | 09.73 | 15 | 03 | 04.8 | 4.644 841 | 1.89 | 19.82 | 19 | 04 | 02 |
| | 31 | 21 | 41 | 19.12 | -15 | 02 | 08.8 | 4.659 883 | 1.89 | 19.76 | 19 | 00 | 16 |
| Nov. | 1 | 21 | 41 | 29.27 | 15 | 01 | 08.9 | 4.674 994 | 1.88 | 19.69 | 18 | 56 | 31 |
| | 2 | 21 | 41 | 40.18 | 15 | 00 | 05.2 | 4.690 171 | 1.88 | 19.63 | 18 | 52 | 46 |
| | 3 | 21 | 41 | 51.85 | 14 | 58 | 57.6 | 4.705 408 | 1.87 | 19.56 | 18 | 49 | 03 |
| | 4 | 21 | 42 | 04.28 | 14 | 57 | 46.1 | 4.720 700 | 1.86 | 19.50 | 18 | 45 | 20 |
| | 5 | 21 | 42 | 17.46 | 14 | 56 | 30.8 | 4.736 044 | 1.86 | 19.44 | 18 | 41 | 37 |
| | 6 | 21 | 42 | 31.40 | -14 | 55 | 11.6 | 4.751 433 | 1.85 | 19.38 | 18 | 37 | 56 |
| | 7 | 21 | 42 | 46.09 | 14 | 53 | 48.6 | 4.766 865 | 1.84 | 19.31 | 18 | 34 | 15 |
| | 8 | 21 | 43 | 01.51 | 14 | 52 | 21.8 | 4.782 333 | 1.84 | 19.25 | 18 | 30 | 35 |
| | 9 | 21 | 43 | 17.67 | 14 | 50 | 51.3 | 4.797 833 | 1.83 | 19.19 | 18 | 26 | 56 |
| | 10 | 21 | 43 | 34.55 | 14 | 49 | 17.1 | 4.813 360 | 1.83 | 19.13 | 18 | 23 | 17 |
| | 11 | 21 | 43 | 52.14 | 14 | 47 | 39.2 | 4.828 911 | 1.82 | 19.06 | 18 | 19 | 40 |
| | 12 | 21 | 44 | 10.45 | -14 | 45 | 57.6 | 4.844 481 | 1.82 | 19.00 | 18 | 16 | 02 |
| | 13 | 21 | 44 | 29.45 | 14 | 44 | 12.4 | 4.860 066 | 1.81 | 18.94 | 18 | 12 | 26 |
| | 14 | 21 | 44 | 49.14 | 14 | 42 | 23.6 | 4.875 661 | 1.80 | 18.88 | 18 | 08 | 50 |
| | 15 | 21 | 45 | 09.52 | 14 | 40 | 31.2 | 4.891 264 | 1.80 | 18.82 | 18 | 05 | 15 |
| | 16 | 21 | 45 | 30.58 | -14 | 38 | 35.2 | 4.906 870 | 1.79 | 18.76 | 18 | 01 | 41 |

**JUPITER, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Nov. | 16 | 21 | 45 | 30.58 | -14 | 38 | 35.2 | 4.906 870 | 1.79 | 18.76 | 18 | 01 | 41 |
| | 17 | 21 | 45 | 52.32 | 14 | 36 | 35.7 | 4.922 475 | 1.79 | 18.70 | 17 | 58 | 07 |
| | 18 | 21 | 46 | 14.73 | 14 | 34 | 32.6 | 4.938 075 | 1.78 | 18.64 | 17 | 54 | 34 |
| | 19 | 21 | 46 | 37.80 | 14 | 32 | 26.1 | 4.953 668 | 1.78 | 18.58 | 17 | 51 | 01 |
| | 20 | 21 | 47 | 01.53 | 14 | 30 | 16.0 | 4.969 250 | 1.77 | 18.53 | 17 | 47 | 29 |
| | 21 | 21 | 47 | 25.90 | 14 | 28 | 02.5 | 4.984 816 | 1.76 | 18.47 | 17 | 43 | 58 |
| | 22 | 21 | 47 | 50.92 | -14 | 25 | 45.6 | 5.000 363 | 1.76 | 18.41 | 17 | 40 | 28 |
| | 23 | 21 | 48 | 16.57 | 14 | 23 | 25.4 | 5.015 889 | 1.75 | 18.35 | 17 | 36 | 58 |
| | 24 | 21 | 48 | 42.85 | 14 | 21 | 01.7 | 5.031 388 | 1.75 | 18.30 | 17 | 33 | 28 |
| | 25 | 21 | 49 | 09.74 | 14 | 18 | 34.8 | 5.046 859 | 1.74 | 18.24 | 17 | 29 | 60 |
| | 26 | 21 | 49 | 37.25 | 14 | 16 | 04.5 | 5.062 296 | 1.74 | 18.19 | 17 | 26 | 31 |
| | 27 | 21 | 50 | 05.36 | 14 | 13 | 31.0 | 5.077 697 | 1.73 | 18.13 | 17 | 23 | 04 |
| | 28 | 21 | 50 | 34.06 | -14 | 10 | 54.1 | 5.093 059 | 1.73 | 18.08 | 17 | 19 | 37 |
| | 29 | 21 | 51 | 03.36 | 14 | 08 | 14.1 | 5.108 376 | 1.72 | 18.02 | 17 | 16 | 11 |
| | 30 | 21 | 51 | 33.25 | 14 | 05 | 30.8 | 5.123 647 | 1.72 | 17.97 | 17 | 12 | 45 |
| Dec. | 1 | 21 | 52 | 03.71 | 14 | 02 | 44.2 | 5.138 867 | 1.71 | 17.91 | 17 | 09 | 20 |
| | 2 | 21 | 52 | 34.75 | 13 | 59 | 54.5 | 5.154 032 | 1.71 | 17.86 | 17 | 05 | 55 |
| | 3 | 21 | 53 | 06.36 | 13 | 57 | 01.5 | 5.169 138 | 1.70 | 17.81 | 17 | 02 | 31 |
| | 4 | 21 | 53 | 38.53 | -13 | 54 | 05.4 | 5.184 182 | 1.70 | 17.76 | 16 | 59 | 08 |
| | 5 | 21 | 54 | 11.25 | 13 | 51 | 06.1 | 5.199 160 | 1.69 | 17.71 | 16 | 55 | 45 |
| | 6 | 21 | 54 | 44.52 | 13 | 48 | 03.8 | 5.214 068 | 1.69 | 17.66 | 16 | 52 | 22 |
| | 7 | 21 | 55 | 18.33 | 13 | 44 | 58.4 | 5.228 903 | 1.68 | 17.61 | 16 | 49 | 00 |
| | 8 | 21 | 55 | 52.66 | 13 | 41 | 50.1 | 5.243 660 | 1.68 | 17.56 | 16 | 45 | 39 |
| | 9 | 21 | 56 | 27.49 | 13 | 38 | 38.7 | 5.258 337 | 1.67 | 17.51 | 16 | 42 | 18 |
| | 10 | 21 | 57 | 02.84 | -13 | 35 | 24.4 | 5.272 930 | 1.67 | 17.46 | 16 | 38 | 57 |
| | 11 | 21 | 57 | 38.67 | 13 | 32 | 07.2 | 5.287 436 | 1.66 | 17.41 | 16 | 35 | 38 |
| | 12 | 21 | 58 | 15.00 | 13 | 28 | 47.1 | 5.301 853 | 1.66 | 17.36 | 16 | 32 | 18 |
| | 13 | 21 | 58 | 51.81 | 13 | 25 | 24.1 | 5.316 177 | 1.65 | 17.32 | 16 | 28 | 59 |
| | 14 | 21 | 59 | 29.09 | 13 | 21 | 58.2 | 5.330 406 | 1.65 | 17.27 | 16 | 25 | 41 |
| | 15 | 22 | 00 | 06.84 | 13 | 18 | 29.5 | 5.344 537 | 1.65 | 17.23 | 16 | 22 | 23 |
| | 16 | 22 | 00 | 45.05 | -13 | 14 | 58.1 | 5.358 567 | 1.64 | 17.18 | 16 | 19 | 05 |
| | 17 | 22 | 01 | 23.71 | 13 | 11 | 23.9 | 5.372 493 | 1.64 | 17.14 | 16 | 15 | 48 |
| | 18 | 22 | 02 | 02.82 | 13 | 07 | 46.9 | 5.386 315 | 1.63 | 17.09 | 16 | 12 | 31 |
| | 19 | 22 | 02 | 42.36 | 13 | 04 | 07.3 | 5.400 027 | 1.63 | 17.05 | 16 | 09 | 15 |
| | 20 | 22 | 03 | 22.34 | 13 | 00 | 25.0 | 5.413 629 | 1.62 | 17.01 | 16 | 05 | 59 |
| | 21 | 22 | 04 | 02.73 | 12 | 56 | 40.1 | 5.427 118 | 1.62 | 16.96 | 16 | 02 | 44 |
| | 22 | 22 | 04 | 43.54 | -12 | 52 | 52.5 | 5.440 491 | 1.62 | 16.92 | 15 | 59 | 29 |
| | 23 | 22 | 05 | 24.75 | 12 | 49 | 02.5 | 5.453 746 | 1.61 | 16.88 | 15 | 56 | 14 |
| | 24 | 22 | 06 | 06.36 | 12 | 45 | 09.9 | 5.466 880 | 1.61 | 16.84 | 15 | 52 | 60 |
| | 25 | 22 | 06 | 48.37 | 12 | 41 | 14.7 | 5.479 891 | 1.60 | 16.80 | 15 | 49 | 46 |
| | 26 | 22 | 07 | 30.75 | 12 | 37 | 17.1 | 5.492 776 | 1.60 | 16.76 | 15 | 46 | 32 |
| | 27 | 22 | 08 | 13.52 | 12 | 33 | 17.0 | 5.505 534 | 1.60 | 16.72 | 15 | 43 | 19 |
| | 28 | 22 | 08 | 56.66 | -12 | 29 | 14.4 | 5.518 160 | 1.59 | 16.68 | 15 | 40 | 06 |
| | 29 | 22 | 09 | 40.17 | 12 | 25 | 09.4 | 5.530 653 | 1.59 | 16.65 | 15 | 36 | 54 |
| | 30 | 22 | 10 | 24.05 | 12 | 21 | 02.0 | 5.543 011 | 1.59 | 16.61 | 15 | 33 | 42 |
| | 31 | 22 | 11 | 08.28 | 12 | 16 | 52.1 | 5.555 229 | 1.58 | 16.57 | 15 | 30 | 30 |
| | 32 | 22 | 11 | 52.87 | -12 | 12 | 39.9 | 5.567 306 | 1.58 | 16.54 | 15 | 27 | 19 |

**SATURN, 2021**

HELIOCENTRIC POSITIONS FOR $0^h$ TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

| Date | | Heliocentric Longitude ° | ′ | ″ | Heliocentric Latitude ° | ′ | ″ | Radius Vector | Date | | Heliocentric Longitude ° | ′ | ″ | Heliocentric Latitude ° | ′ | ″ | Radius Vector |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan. | 1 | 303 | 38 | 39.4 | -0 | 25 | 25.3 | 9.987 013 | Apr. | 3 | 306 | 27 | 36.8 | -0 | 32 | 36.4 | 9.971 878 |
| | 3 | 303 | 42 | 19.4 | 0 | 25 | 34.7 | 9.986 697 | | 5 | 306 | 31 | 17.5 | 0 | 32 | 45.7 | 9.971 535 |
| | 5 | 303 | 45 | 59.5 | 0 | 25 | 44.1 | 9.986 381 | | 7 | 306 | 34 | 58.3 | 0 | 32 | 55.0 | 9.971 191 |
| | 7 | 303 | 49 | 39.6 | 0 | 25 | 53.5 | 9.986 064 | | 9 | 306 | 38 | 39.0 | 0 | 33 | 04.4 | 9.970 847 |
| | 9 | 303 | 53 | 19.7 | 0 | 26 | 02.9 | 9.985 747 | | 11 | 306 | 42 | 19.8 | 0 | 33 | 13.7 | 9.970 502 |
| | 11 | 303 | 56 | 59.8 | 0 | 26 | 12.3 | 9.985 429 | | 13 | 306 | 46 | 00.6 | 0 | 33 | 23.0 | 9.970 157 |
| | 13 | 304 | 00 | 39.9 | -0 | 26 | 21.7 | 9.985 110 | | 15 | 306 | 49 | 41.4 | -0 | 33 | 32.3 | 9.969 811 |
| | 15 | 304 | 04 | 20.0 | 0 | 26 | 31.1 | 9.984 791 | | 17 | 306 | 53 | 22.2 | 0 | 33 | 41.7 | 9.969 465 |
| | 17 | 304 | 08 | 00.2 | 0 | 26 | 40.5 | 9.984 471 | | 19 | 306 | 57 | 03.1 | 0 | 33 | 51.0 | 9.969 118 |
| | 19 | 304 | 11 | 40.3 | 0 | 26 | 49.9 | 9.984 151 | | 21 | 307 | 00 | 43.9 | 0 | 34 | 00.3 | 9.968 770 |
| | 21 | 304 | 15 | 20.5 | 0 | 26 | 59.3 | 9.983 830 | | 23 | 307 | 04 | 24.8 | 0 | 34 | 09.6 | 9.968 422 |
| | 23 | 304 | 19 | 00.7 | 0 | 27 | 08.6 | 9.983 508 | | 25 | 307 | 08 | 05.7 | 0 | 34 | 18.9 | 9.968 073 |
| | 25 | 304 | 22 | 40.9 | -0 | 27 | 18.0 | 9.983 186 | | 27 | 307 | 11 | 46.6 | -0 | 34 | 28.3 | 9.967 724 |
| | 27 | 304 | 26 | 21.2 | 0 | 27 | 27.4 | 9.982 863 | | 29 | 307 | 15 | 27.5 | 0 | 34 | 37.6 | 9.967 374 |
| | 29 | 304 | 30 | 01.4 | 0 | 27 | 36.8 | 9.982 540 | May | 1 | 307 | 19 | 08.4 | 0 | 34 | 46.9 | 9.967 023 |
| | 31 | 304 | 33 | 41.6 | 0 | 27 | 46.2 | 9.982 216 | | 3 | 307 | 22 | 49.4 | 0 | 34 | 56.2 | 9.966 672 |
| Feb. | 2 | 304 | 37 | 21.9 | 0 | 27 | 55.6 | 9.981 892 | | 5 | 307 | 26 | 30.3 | 0 | 35 | 05.5 | 9.966 320 |
| | 4 | 304 | 41 | 02.2 | 0 | 28 | 05.0 | 9.981 566 | | 7 | 307 | 30 | 11.3 | 0 | 35 | 14.8 | 9.965 968 |
| | 6 | 304 | 44 | 42.5 | -0 | 28 | 14.3 | 9.981 241 | | 9 | 307 | 33 | 52.3 | -0 | 35 | 24.1 | 9.965 615 |
| | 8 | 304 | 48 | 22.8 | 0 | 28 | 23.7 | 9.980 914 | | 11 | 307 | 37 | 33.3 | 0 | 35 | 33.5 | 9.965 262 |
| | 10 | 304 | 52 | 03.2 | 0 | 28 | 33.1 | 9.980 587 | | 13 | 307 | 41 | 14.3 | 0 | 35 | 42.7 | 9.964 908 |
| | 12 | 304 | 55 | 43.5 | 0 | 28 | 42.4 | 9.980 260 | | 15 | 307 | 44 | 55.4 | 0 | 35 | 52.1 | 9.964 554 |
| | 14 | 304 | 59 | 23.8 | 0 | 28 | 51.8 | 9.979 932 | | 17 | 307 | 48 | 36.4 | 0 | 36 | 01.3 | 9.964 198 |
| | 16 | 305 | 03 | 04.2 | 0 | 29 | 01.2 | 9.979 603 | | 19 | 307 | 52 | 17.5 | 0 | 36 | 10.7 | 9.963 843 |
| | 18 | 305 | 06 | 44.6 | -0 | 29 | 10.6 | 9.979 273 | | 21 | 307 | 55 | 58.6 | -0 | 36 | 19.9 | 9.963 487 |
| | 20 | 305 | 10 | 25.0 | 0 | 29 | 19.9 | 9.978 943 | | 23 | 307 | 59 | 39.7 | 0 | 36 | 29.2 | 9.963 130 |
| | 22 | 305 | 14 | 05.4 | 0 | 29 | 29.3 | 9.978 613 | | 25 | 308 | 03 | 20.8 | 0 | 36 | 38.5 | 9.962 772 |
| | 24 | 305 | 17 | 45.8 | 0 | 29 | 38.7 | 9.978 282 | | 27 | 308 | 07 | 02.0 | 0 | 36 | 47.8 | 9.962 414 |
| | 26 | 305 | 21 | 26.3 | 0 | 29 | 48.0 | 9.977 950 | | 29 | 308 | 10 | 43.1 | 0 | 36 | 57.1 | 9.962 056 |
| | 28 | 305 | 25 | 06.7 | 0 | 29 | 57.4 | 9.977 618 | | 31 | 308 | 14 | 24.3 | 0 | 37 | 06.4 | 9.961 697 |
| Mar. | 2 | 305 | 28 | 47.2 | -0 | 30 | 06.8 | 9.977 285 | June | 2 | 308 | 18 | 05.5 | -0 | 37 | 15.7 | 9.961 337 |
| | 4 | 305 | 32 | 27.7 | 0 | 30 | 16.1 | 9.976 951 | | 4 | 308 | 21 | 46.7 | 0 | 37 | 25.0 | 9.960 977 |
| | 6 | 305 | 36 | 08.2 | 0 | 30 | 25.5 | 9.976 617 | | 6 | 308 | 25 | 27.9 | 0 | 37 | 34.2 | 9.960 616 |
| | 8 | 305 | 39 | 48.7 | 0 | 30 | 34.9 | 9.976 283 | | 8 | 308 | 29 | 09.1 | 0 | 37 | 43.5 | 9.960 255 |
| | 10 | 305 | 43 | 29.2 | 0 | 30 | 44.2 | 9.975 947 | | 10 | 308 | 32 | 50.4 | 0 | 37 | 52.8 | 9.959 893 |
| | 12 | 305 | 47 | 09.8 | 0 | 30 | 53.6 | 9.975 611 | | 12 | 308 | 36 | 31.7 | 0 | 38 | 02.1 | 9.959 530 |
| | 14 | 305 | 50 | 50.3 | -0 | 31 | 02.9 | 9.975 275 | | 14 | 308 | 40 | 12.9 | -0 | 38 | 11.3 | 9.959 167 |
| | 16 | 305 | 54 | 30.9 | 0 | 31 | 12.2 | 9.974 938 | | 16 | 308 | 43 | 54.2 | 0 | 38 | 20.6 | 9.958 804 |
| | 18 | 305 | 58 | 11.5 | 0 | 31 | 21.6 | 9.974 600 | | 18 | 308 | 47 | 35.5 | 0 | 38 | 29.9 | 9.958 439 |
| | 20 | 306 | 01 | 52.1 | 0 | 31 | 30.9 | 9.974 262 | | 20 | 308 | 51 | 16.9 | 0 | 38 | 39.1 | 9.958 075 |
| | 22 | 306 | 05 | 32.8 | 0 | 31 | 40.3 | 9.973 923 | | 22 | 308 | 54 | 58.2 | 0 | 38 | 48.4 | 9.957 709 |
| | 24 | 306 | 09 | 13.4 | 0 | 31 | 49.7 | 9.973 584 | | 24 | 308 | 58 | 39.6 | 0 | 38 | 57.7 | 9.957 343 |
| | 26 | 306 | 12 | 54.0 | -0 | 31 | 59.0 | 9.973 244 | | 26 | 309 | 02 | 21.0 | -0 | 39 | 06.9 | 9.956 977 |
| | 28 | 306 | 16 | 34.7 | 0 | 32 | 08.3 | 9.972 903 | | 28 | 309 | 06 | 02.4 | 0 | 39 | 16.2 | 9.956 610 |
| | 30 | 306 | 20 | 15.4 | 0 | 32 | 17.7 | 9.972 562 | | 30 | 309 | 09 | 43.8 | 0 | 39 | 25.4 | 9.956 242 |
| Apr. | 1 | 306 | 23 | 56.1 | 0 | 32 | 27.0 | 9.972 220 | July | 2 | 309 | 13 | 25.2 | 0 | 39 | 34.7 | 9.955 874 |
| | 3 | 306 | 27 | 36.8 | -0 | 32 | 36.4 | 9.971 878 | | 4 | 309 | 17 | 06.7 | -0 | 39 | 44.0 | 9.955 506 |

**SATURN, 2021**

HELIOCENTRIC POSITIONS FOR $0^h$ TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

| Date | | Heliocentric Longitude | | | Heliocentric Latitude | | | Radius Vector | Date | | Heliocentric Longitude | | | Heliocentric Latitude | | | Radius Vector |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | | ° | ' | " | ° | ' | " | |
| July | 2 | 309 | 13 | 25.2 | -0 | 39 | 34.7 | 9.955 874 | Oct. | 2 | 312 | 03 | 29.6 | -0 | 46 | 38.1 | 9.938 335 |
| | 4 | 309 | 17 | 06.7 | 0 | 39 | 44.0 | 9.955 506 | | 4 | 312 | 07 | 11.8 | 0 | 46 | 47.2 | 9.937 941 |
| | 6 | 309 | 20 | 48.1 | 0 | 39 | 53.2 | 9.955 136 | | 6 | 312 | 10 | 54.1 | 0 | 46 | 56.4 | 9.937 546 |
| | 8 | 309 | 24 | 29.6 | 0 | 40 | 02.5 | 9.954 766 | | 8 | 312 | 14 | 36.4 | 0 | 47 | 05.5 | 9.937 151 |
| | 10 | 309 | 28 | 11.1 | 0 | 40 | 11.7 | 9.954 396 | | 10 | 312 | 18 | 18.7 | 0 | 47 | 14.7 | 9.936 755 |
| | 12 | 309 | 31 | 52.7 | 0 | 40 | 21.0 | 9.954 025 | | 12 | 312 | 22 | 01.0 | 0 | 47 | 23.8 | 9.936 358 |
| | 14 | 309 | 35 | 34.2 | -0 | 40 | 30.2 | 9.953 654 | | 14 | 312 | 25 | 43.3 | -0 | 47 | 33.0 | 9.935 961 |
| | 16 | 309 | 39 | 15.7 | 0 | 40 | 39.4 | 9.953 281 | | 16 | 312 | 29 | 25.7 | 0 | 47 | 42.1 | 9.935 564 |
| | 18 | 309 | 42 | 57.3 | 0 | 40 | 48.7 | 9.952 909 | | 18 | 312 | 33 | 08.0 | 0 | 47 | 51.2 | 9.935 165 |
| | 20 | 309 | 46 | 38.9 | 0 | 40 | 57.9 | 9.952 536 | | 20 | 312 | 36 | 50.4 | 0 | 48 | 00.3 | 9.934 767 |
| | 22 | 309 | 50 | 20.5 | 0 | 41 | 07.2 | 9.952 162 | | 22 | 312 | 40 | 32.8 | 0 | 48 | 09.5 | 9.934 368 |
| | 24 | 309 | 54 | 02.1 | 0 | 41 | 16.4 | 9.951 788 | | 24 | 312 | 44 | 15.2 | 0 | 48 | 18.6 | 9.933 968 |
| | 26 | 309 | 57 | 43.7 | -0 | 41 | 25.6 | 9.951 413 | | 26 | 312 | 47 | 57.7 | -0 | 48 | 27.7 | 9.933 568 |
| | 28 | 310 | 01 | 25.4 | 0 | 41 | 34.9 | 9.951 037 | | 28 | 312 | 51 | 40.1 | 0 | 48 | 36.8 | 9.933 167 |
| | 30 | 310 | 05 | 07.1 | 0 | 41 | 44.1 | 9.950 661 | | 30 | 312 | 55 | 22.6 | 0 | 48 | 46.0 | 9.932 765 |
| Aug. | 1 | 310 | 08 | 48.7 | 0 | 41 | 53.3 | 9.950 285 | Nov. | 1 | 312 | 59 | 05.1 | 0 | 48 | 55.1 | 9.932 363 |
| | 3 | 310 | 12 | 30.4 | 0 | 42 | 02.5 | 9.949 908 | | 3 | 313 | 02 | 47.6 | 0 | 49 | 04.2 | 9.931 961 |
| | 5 | 310 | 16 | 12.2 | 0 | 42 | 11.7 | 9.949 530 | | 5 | 313 | 06 | 30.2 | 0 | 49 | 13.3 | 9.931 558 |
| | 7 | 310 | 19 | 53.9 | -0 | 42 | 20.9 | 9.949 152 | | 7 | 313 | 10 | 12.7 | -0 | 49 | 22.4 | 9.931 155 |
| | 9 | 310 | 23 | 35.7 | 0 | 42 | 30.2 | 9.948 773 | | 9 | 313 | 13 | 55.3 | 0 | 49 | 31.5 | 9.930 750 |
| | 11 | 310 | 27 | 17.4 | 0 | 42 | 39.4 | 9.948 393 | | 11 | 313 | 17 | 37.9 | 0 | 49 | 40.6 | 9.930 346 |
| | 13 | 310 | 30 | 59.2 | 0 | 42 | 48.6 | 9.948 014 | | 13 | 313 | 21 | 20.5 | 0 | 49 | 49.7 | 9.929 941 |
| | 15 | 310 | 34 | 41.0 | 0 | 42 | 57.8 | 9.947 633 | | 15 | 313 | 25 | 03.1 | 0 | 49 | 58.8 | 9.929 535 |
| | 17 | 310 | 38 | 22.8 | 0 | 43 | 07.0 | 9.947 252 | | 17 | 313 | 28 | 45.7 | 0 | 50 | 07.8 | 9.929 129 |
| | 19 | 310 | 42 | 04.7 | -0 | 43 | 16.2 | 9.946 870 | | 19 | 313 | 32 | 28.4 | -0 | 50 | 16.9 | 9.928 722 |
| | 21 | 310 | 45 | 46.5 | 0 | 43 | 25.4 | 9.946 488 | | 21 | 313 | 36 | 11.1 | 0 | 50 | 26.0 | 9.928 315 |
| | 23 | 310 | 49 | 28.4 | 0 | 43 | 34.6 | 9.946 106 | | 23 | 313 | 39 | 53.7 | 0 | 50 | 35.1 | 9.927 907 |
| | 25 | 310 | 53 | 10.3 | 0 | 43 | 43.8 | 9.945 722 | | 25 | 313 | 43 | 36.5 | 0 | 50 | 44.2 | 9.927 499 |
| | 27 | 310 | 56 | 52.2 | 0 | 43 | 53.0 | 9.945 339 | | 27 | 313 | 47 | 19.2 | 0 | 50 | 53.3 | 9.927 090 |
| | 29 | 311 | 00 | 34.1 | 0 | 44 | 02.2 | 9.944 954 | | 29 | 313 | 51 | 01.9 | 0 | 51 | 02.3 | 9.926 681 |
| | 31 | 311 | 04 | 16.1 | -0 | 44 | 11.4 | 9.944 569 | Dec. | 1 | 313 | 54 | 44.7 | -0 | 51 | 11.4 | 9.926 271 |
| Sept. | 2 | 311 | 07 | 58.0 | 0 | 44 | 20.6 | 9.944 184 | | 3 | 313 | 58 | 27.5 | 0 | 51 | 20.5 | 9.925 861 |
| | 4 | 311 | 11 | 40.0 | 0 | 44 | 29.8 | 9.943 798 | | 5 | 314 | 02 | 10.3 | 0 | 51 | 29.5 | 9.925 450 |
| | 6 | 311 | 15 | 22.0 | 0 | 44 | 38.9 | 9.943 411 | | 7 | 314 | 05 | 53.1 | 0 | 51 | 38.6 | 9.925 038 |
| | 8 | 311 | 19 | 04.0 | 0 | 44 | 48.1 | 9.943 024 | | 9 | 314 | 09 | 35.9 | 0 | 51 | 47.7 | 9.924 626 |
| | 10 | 311 | 22 | 46.1 | 0 | 44 | 57.3 | 9.942 636 | | 11 | 314 | 13 | 18.8 | 0 | 51 | 56.7 | 9.924 214 |
| | 12 | 311 | 26 | 28.1 | -0 | 45 | 06.5 | 9.942 248 | | 13 | 314 | 17 | 01.7 | -0 | 52 | 05.7 | 9.923 801 |
| | 14 | 311 | 30 | 10.2 | 0 | 45 | 15.6 | 9.941 859 | | 15 | 314 | 20 | 44.6 | 0 | 52 | 14.8 | 9.923 388 |
| | 16 | 311 | 33 | 52.3 | 0 | 45 | 24.8 | 9.941 470 | | 17 | 314 | 24 | 27.5 | 0 | 52 | 23.8 | 9.922 973 |
| | 18 | 311 | 37 | 34.4 | 0 | 45 | 34.0 | 9.941 080 | | 19 | 314 | 28 | 10.4 | 0 | 52 | 32.9 | 9.922 559 |
| | 20 | 311 | 41 | 16.5 | 0 | 45 | 43.2 | 9.940 690 | | 21 | 314 | 31 | 53.4 | 0 | 52 | 41.9 | 9.922 144 |
| | 22 | 311 | 44 | 58.6 | 0 | 45 | 52.3 | 9.940 299 | | 23 | 314 | 35 | 36.3 | 0 | 52 | 51.0 | 9.921 728 |
| | 24 | 311 | 48 | 40.8 | -0 | 46 | 01.5 | 9.939 907 | | 25 | 314 | 39 | 19.3 | -0 | 53 | 00.0 | 9.921 312 |
| | 26 | 311 | 52 | 23.0 | 0 | 46 | 10.6 | 9.939 515 | | 27 | 314 | 43 | 02.4 | 0 | 53 | 09.1 | 9.920 896 |
| | 28 | 311 | 56 | 05.1 | 0 | 46 | 19.8 | 9.939 122 | | 29 | 314 | 46 | 45.4 | 0 | 53 | 18.1 | 9.920 479 |
| | 30 | 311 | 59 | 47.4 | 0 | 46 | 29.0 | 9.938 729 | | 31 | 314 | 50 | 28.4 | 0 | 53 | 27.1 | 9.920 061 |
| Oct. | 2 | 312 | 03 | 29.6 | -0 | 46 | 38.1 | 9.938 335 | | 33 | 314 | 54 | 11.5 | -0 | 53 | 36.1 | 9.919 643 |

**SATURN, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| Jan. | 0 | 301 | 30 | 39.6 | -0 | 23 | 13.9 | Feb. | 15 | 306 | 54 | 43.9 | -0 | 26 | 29.0 |
| | 1 | 301 | 37 | 28.7 | 0 | 23 | 17.4 | | 16 | 307 | 01 | 35.6 | 0 | 26 | 34.0 |
| | 2 | 301 | 44 | 19.4 | 0 | 23 | 20.9 | | 17 | 307 | 08 | 25.8 | 0 | 26 | 39.2 |
| | 3 | 301 | 51 | 11.7 | 0 | 23 | 24.5 | | 18 | 307 | 15 | 14.4 | 0 | 26 | 44.4 |
| | 4 | 301 | 58 | 05.4 | 0 | 23 | 28.1 | | 19 | 307 | 22 | 01.2 | 0 | 26 | 49.6 |
| | 5 | 302 | 05 | 00.5 | 0 | 23 | 31.7 | | 20 | 307 | 28 | 46.4 | 0 | 26 | 54.8 |
| | 6 | 302 | 11 | 56.9 | -0 | 23 | 35.3 | | 21 | 307 | 35 | 29.7 | -0 | 27 | 00.1 |
| | 7 | 302 | 18 | 54.7 | 0 | 23 | 39.0 | | 22 | 307 | 42 | 11.1 | 0 | 27 | 05.5 |
| | 8 | 302 | 25 | 53.7 | 0 | 23 | 42.8 | | 23 | 307 | 48 | 50.5 | 0 | 27 | 10.9 |
| | 9 | 302 | 32 | 54.0 | 0 | 23 | 46.5 | | 24 | 307 | 55 | 27.9 | 0 | 27 | 16.3 |
| | 10 | 302 | 39 | 55.4 | 0 | 23 | 50.3 | | 25 | 308 | 02 | 03.2 | 0 | 27 | 21.7 |
| | 11 | 302 | 46 | 57.9 | 0 | 23 | 54.1 | | 26 | 308 | 08 | 36.3 | 0 | 27 | 27.3 |
| | 12 | 302 | 54 | 01.3 | -0 | 23 | 58.0 | | 27 | 308 | 15 | 07.1 | -0 | 27 | 32.8 |
| | 13 | 303 | 01 | 05.6 | 0 | 24 | 01.8 | | 28 | 308 | 21 | 35.6 | 0 | 27 | 38.4 |
| | 14 | 303 | 08 | 10.7 | 0 | 24 | 05.7 | Mar. | 1 | 308 | 28 | 01.7 | 0 | 27 | 44.1 |
| | 15 | 303 | 15 | 16.5 | 0 | 24 | 09.7 | | 2 | 308 | 34 | 25.4 | 0 | 27 | 49.8 |
| | 16 | 303 | 22 | 22.8 | 0 | 24 | 13.7 | | 3 | 308 | 40 | 46.7 | 0 | 27 | 55.5 |
| | 17 | 303 | 29 | 29.6 | 0 | 24 | 17.7 | | 4 | 308 | 47 | 05.5 | 0 | 28 | 01.3 |
| | 18 | 303 | 36 | 36.9 | -0 | 24 | 21.7 | | 5 | 308 | 53 | 21.8 | -0 | 28 | 07.1 |
| | 19 | 303 | 43 | 44.6 | 0 | 24 | 25.7 | | 6 | 308 | 59 | 35.5 | 0 | 28 | 13.0 |
| | 20 | 303 | 50 | 52.7 | 0 | 24 | 29.8 | | 7 | 309 | 05 | 46.6 | 0 | 28 | 18.9 |
| | 21 | 303 | 58 | 01.0 | 0 | 24 | 34.0 | | 8 | 309 | 11 | 54.8 | 0 | 28 | 24.8 |
| | 22 | 304 | 05 | 09.7 | 0 | 24 | 38.1 | | 9 | 309 | 18 | 00.2 | 0 | 28 | 30.8 |
| | 23 | 304 | 12 | 18.5 | 0 | 24 | 42.4 | | 10 | 309 | 24 | 02.6 | 0 | 28 | 36.9 |
| | 24 | 304 | 19 | 27.3 | -0 | 24 | 47.5 | | 11 | 309 | 30 | 01.9 | -0 | 28 | 43.0 |
| | 25 | 304 | 26 | 35.4 | 0 | 24 | 51.0 | | 12 | 309 | 35 | 58.2 | 0 | 28 | 49.1 |
| | 26 | 304 | 33 | 44.4 | 0 | 24 | 55.1 | | 13 | 309 | 41 | 51.3 | 0 | 28 | 55.3 |
| | 27 | 304 | 40 | 53.1 | 0 | 24 | 59.4 | | 14 | 309 | 47 | 41.1 | 0 | 29 | 01.5 |
| | 28 | 304 | 48 | 01.7 | 0 | 25 | 03.8 | | 15 | 309 | 53 | 27.7 | 0 | 29 | 07.7 |
| | 29 | 304 | 55 | 09.8 | 0 | 25 | 08.2 | | 16 | 309 | 59 | 10.9 | 0 | 29 | 14.0 |
| | 30 | 305 | 02 | 17.6 | -0 | 25 | 12.6 | | 17 | 310 | 04 | 50.8 | -0 | 29 | 20.4 |
| | 31 | 305 | 09 | 25.0 | 0 | 25 | 17.1 | | 18 | 310 | 10 | 27.2 | 0 | 29 | 26.7 |
| Feb. | 1 | 305 | 16 | 31.9 | 0 | 25 | 21.6 | | 19 | 310 | 16 | 00.2 | 0 | 29 | 33.2 |
| | 2 | 305 | 23 | 38.2 | 0 | 25 | 26.1 | | 20 | 310 | 21 | 29.7 | 0 | 29 | 39.6 |
| | 3 | 305 | 30 | 44.0 | 0 | 25 | 30.7 | | 21 | 310 | 26 | 55.5 | 0 | 29 | 46.1 |
| | 4 | 305 | 37 | 49.1 | 0 | 25 | 35.4 | | 22 | 310 | 32 | 17.6 | 0 | 29 | 52.7 |
| | 5 | 305 | 44 | 53.6 | +0 | 25 | 40.0 | | 23 | 310 | 37 | 36.1 | -0 | 29 | 59.3 |
| | 6 | 305 | 51 | 57.4 | 0 | 25 | 44.8 | | 24 | 310 | 42 | 50.7 | 0 | 30 | 05.9 |
| | 7 | 305 | 59 | 00.3 | 0 | 25 | 49.5 | | 25 | 310 | 48 | 01.4 | 0 | 30 | 12.6 |
| | 8 | 306 | 06 | 02.4 | 0 | 25 | 54.3 | | 26 | 310 | 53 | 08.2 | 0 | 30 | 19.3 |
| | 9 | 306 | 13 | 03.5 | 0 | 25 | 59.2 | | 27 | 310 | 58 | 10.9 | 0 | 30 | 26.1 |
| | 10 | 306 | 20 | 03.4 | 0 | 26 | 04.0 | | 28 | 311 | 03 | 09.6 | 0 | 30 | 32.9 |
| | 11 | 306 | 27 | 02.2 | -0 | 26 | 08.9 | | 29 | 311 | 08 | 04.3 | -0 | 30 | 39.8 |
| | 12 | 306 | 33 | 59.7 | 0 | 26 | 13.9 | | 30 | 311 | 12 | 54.9 | 0 | 30 | 46.7 |
| | 13 | 306 | 40 | 55.9 | 0 | 26 | 18.9 | | 31 | 311 | 17 | 41.3 | 0 | 30 | 53.7 |
| | 14 | 306 | 47 | 50.6 | 0 | 26 | 23.9 | Apr. | 1 | 311 | 22 | 23.7 | 0 | 31 | 00.7 |
| | 15 | 306 | 54 | 43.9 | -0 | 26 | 29.0 | | 2 | 311 | 27 | 01.8 | -0 | 31 | 07.7 |

**SATURN, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| Apr. | 1 | 311 | 22 | 23.7 | -0 | 31 | 00.7 | May | 17 | 313 | 29 | 02.0 | -0 | 37 | 01.8 |
| | 2 | 311 | 27 | 01.8 | 0 | 31 | 07.7 | | 18 | 313 | 29 | 36.7 | 0 | 37 | 10.3 |
| | 3 | 311 | 31 | 35.7 | 0 | 31 | 14.8 | | 19 | 313 | 30 | 05.4 | 0 | 37 | 18.8 |
| | 4 | 311 | 36 | 05.2 | 0 | 31 | 21.9 | | 20 | 313 | 30 | 28.3 | 0 | 37 | 27.3 |
| | 5 | 311 | 40 | 30.2 | 0 | 31 | 29.1 | | 21 | 313 | 30 | 45.2 | 0 | 37 | 35.8 |
| | 6 | 311 | 44 | 50.7 | 0 | 31 | 36.3 | | 22 | 313 | 30 | 56.3 | 0 | 37 | 44.3 |
| | 7 | 311 | 49 | 06.6 | -0 | 31 | 43.6 | | 23 | 313 | 31 | 01.4 | -0 | 37 | 52.9 |
| | 8 | 311 | 53 | 17.9 | 0 | 31 | 50.8 | | 24 | 313 | 31 | 00.8 | 0 | 38 | 01.4 |
| | 9 | 311 | 57 | 24.4 | 0 | 31 | 58.2 | | 25 | 313 | 30 | 54.4 | 0 | 38 | 10.0 |
| | 10 | 312 | 01 | 26.1 | 0 | 32 | 05.5 | | 26 | 313 | 30 | 42.2 | 0 | 38 | 18.5 |
| | 11 | 312 | 05 | 23.1 | 0 | 32 | 12.9 | | 27 | 313 | 30 | 24.3 | 0 | 38 | 27.1 |
| | 12 | 312 | 09 | 15.3 | 0 | 32 | 20.4 | | 28 | 313 | 30 | 00.7 | 0 | 38 | 35.7 |
| | 13 | 312 | 13 | 02.6 | -0 | 32 | 27.9 | | 29 | 313 | 29 | 31.3 | -0 | 38 | 44.2 |
| | 14 | 312 | 16 | 44.9 | 0 | 32 | 35.4 | | 30 | 313 | 28 | 56.1 | 0 | 38 | 52.8 |
| | 15 | 312 | 20 | 22.4 | 0 | 32 | 42.9 | | 31 | 313 | 28 | 15.0 | 0 | 39 | 01.3 |
| | 16 | 312 | 23 | 54.9 | 0 | 32 | 50.5 | June | 1 | 313 | 27 | 28.2 | 0 | 39 | 09.9 |
| | 17 | 312 | 27 | 22.3 | 0 | 32 | 58.1 | | 2 | 313 | 26 | 35.5 | 0 | 39 | 18.4 |
| | 18 | 312 | 30 | 44.6 | 0 | 33 | 05.8 | | 3 | 313 | 25 | 37.1 | 0 | 39 | 27.0 |
| | 19 | 312 | 34 | 01.9 | -0 | 33 | 13.5 | | 4 | 313 | 24 | 32.9 | -0 | 39 | 35.5 |
| | 20 | 312 | 37 | 13.9 | 0 | 33 | 21.2 | | 5 | 313 | 23 | 23.1 | 0 | 39 | 44.0 |
| | 21 | 312 | 40 | 20.6 | 0 | 33 | 29.0 | | 6 | 313 | 22 | 07.7 | 0 | 39 | 52.5 |
| | 22 | 312 | 43 | 22.1 | 0 | 33 | 36.8 | | 7 | 313 | 20 | 46.7 | 0 | 40 | 00.9 |
| | 23 | 312 | 46 | 18.3 | 0 | 33 | 44.7 | | 8 | 313 | 19 | 20.1 | 0 | 40 | 09.4 |
| | 24 | 312 | 49 | 09.1 | 0 | 33 | 52.6 | | 9 | 313 | 17 | 48.0 | 0 | 40 | 17.8 |
| | 25 | 312 | 51 | 54.5 | -0 | 34 | 00.5 | | 10 | 313 | 16 | 10.5 | -0 | 40 | 26.3 |
| | 26 | 312 | 54 | 34.6 | 0 | 34 | 08.5 | | 11 | 313 | 14 | 27.6 | 0 | 40 | 34.7 |
| | 27 | 312 | 57 | 09.3 | 0 | 34 | 16.5 | | 12 | 313 | 12 | 39.2 | 0 | 40 | 43.0 |
| | 28 | 312 | 59 | 38.6 | 0 | 34 | 24.5 | | 13 | 313 | 10 | 45.5 | 0 | 40 | 51.4 |
| | 29 | 313 | 02 | 02.5 | 0 | 34 | 32.6 | | 14 | 313 | 08 | 46.6 | 0 | 40 | 59.7 |
| | 30 | 313 | 04 | 21.0 | 0 | 34 | 40.7 | | 15 | 313 | 06 | 42.3 | 0 | 41 | 08.0 |
| May | 1 | 313 | 06 | 34.0 | -0 | 34 | 48.8 | | 16 | 313 | 04 | 32.9 | -0 | 41 | 16.3 |
| | 2 | 313 | 08 | 41.4 | 0 | 34 | 56.9 | | 17 | 313 | 02 | 18.3 | 0 | 41 | 24.6 |
| | 3 | 313 | 10 | 43.2 | 0 | 35 | 05.1 | | 18 | 312 | 59 | 58.7 | 0 | 41 | 32.8 |
| | 4 | 313 | 12 | 39.2 | 0 | 35 | 13.3 | | 19 | 312 | 57 | 34.0 | 0 | 41 | 41.0 |
| | 5 | 313 | 14 | 29.6 | 0 | 35 | 21.5 | | 20 | 312 | 55 | 04.5 | 0 | 41 | 49.2 |
| | 6 | 313 | 16 | 14.2 | 0 | 35 | 29.8 | | 21 | 312 | 52 | 30.3 | 0 | 41 | 57.3 |
| | 7 | 313 | 17 | 53.0 | -0 | 35 | 38.1 | | 22 | 312 | 49 | 51.3 | -0 | 42 | 05.4 |
| | 8 | 313 | 19 | 26.0 | 0 | 35 | 46.3 | | 23 | 312 | 47 | 07.8 | 0 | 42 | 13.4 |
| | 9 | 313 | 20 | 53.3 | 0 | 35 | 54.7 | | 24 | 312 | 44 | 19.8 | 0 | 42 | 21.4 |
| | 10 | 313 | 22 | 14.8 | 0 | 36 | 03.0 | | 25 | 312 | 41 | 27.2 | 0 | 42 | 29.4 |
| | 11 | 313 | 23 | 30.4 | 0 | 36 | 11.3 | | 26 | 312 | 38 | 30.2 | 0 | 42 | 37.3 |
| | 12 | 313 | 24 | 40.3 | 0 | 36 | 19.7 | | 27 | 312 | 35 | 28.8 | 0 | 42 | 45.2 |
| | 13 | 313 | 25 | 44.3 | -0 | 36 | 28.1 | | 28 | 312 | 32 | 23.0 | -0 | 42 | 53.0 |
| | 14 | 313 | 26 | 42.5 | 0 | 36 | 36.5 | | 29 | 312 | 29 | 12.9 | 0 | 43 | 00.8 |
| | 15 | 313 | 27 | 34.9 | 0 | 36 | 44.9 | | 30 | 312 | 25 | 58.7 | 0 | 43 | 08.5 |
| | 16 | 313 | 28 | 21.4 | 0 | 36 | 53.4 | July | 1 | 312 | 22 | 40.4 | 0 | 43 | 16.2 |
| | 17 | 313 | 29 | 02.0 | -0 | 37 | 01.8 | | 2 | 312 | 19 | 18.1 | -0 | 43 | 23.8 |

**SATURN, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude ° | ' | " | Apparent Geocentric Latitude ° | ' | " | Date | | Apparent Geocentric Longitude ° | ' | " | Apparent Geocentric Latitude ° | ' | " |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| July | 1 | 312 | 22 | 40.4 | -0 | 43 | 16.2 | Aug. | 16 | 309 | 10 | 40.9 | -0 | 47 | 46.0 |
| | 2 | 312 | 19 | 18.1 | 0 | 43 | 23.8 | | 17 | 309 | 06 | 26.8 | 0 | 47 | 49.7 |
| | 3 | 312 | 15 | 51.9 | 0 | 43 | 31.3 | | 18 | 309 | 02 | 14.9 | 0 | 47 | 53.3 |
| | 4 | 312 | 12 | 22.0 | 0 | 43 | 38.8 | | 19 | 308 | 58 | 05.1 | 0 | 47 | 56.9 |
| | 5 | 312 | 08 | 48.4 | 0 | 43 | 46.2 | | 20 | 308 | 53 | 57.5 | 0 | 48 | 00.3 |
| | 6 | 312 | 05 | 11.3 | 0 | 43 | 53.5 | | 21 | 308 | 49 | 52.3 | 0 | 48 | 03.7 |
| | 7 | 312 | 01 | 30.7 | -0 | 44 | 00.8 | | 22 | 308 | 45 | 49.5 | -0 | 48 | 06.9 |
| | 8 | 311 | 57 | 46.8 | 0 | 44 | 08.0 | | 23 | 308 | 41 | 49.2 | 0 | 48 | 10.1 |
| | 9 | 311 | 53 | 59.7 | 0 | 44 | 15.2 | | 24 | 308 | 37 | 51.6 | 0 | 48 | 13.1 |
| | 10 | 311 | 50 | 09.5 | 0 | 44 | 22.3 | | 25 | 308 | 33 | 56.8 | 0 | 48 | 16.1 |
| | 11 | 311 | 46 | 16.2 | 0 | 44 | 29.3 | | 26 | 308 | 30 | 04.9 | 0 | 48 | 19.0 |
| | 12 | 311 | 42 | 20.0 | 0 | 44 | 36.2 | | 27 | 308 | 26 | 16.1 | 0 | 48 | 21.7 |
| | 13 | 311 | 38 | 21.0 | -0 | 44 | 43.1 | | 28 | 308 | 22 | 30.5 | -0 | 48 | 24.4 |
| | 14 | 311 | 34 | 19.3 | 0 | 44 | 49.9 | | 29 | 308 | 18 | 48.2 | 0 | 48 | 27.0 |
| | 15 | 311 | 30 | 15.0 | 0 | 44 | 56.7 | | 30 | 308 | 15 | 09.4 | 0 | 48 | 29.5 |
| | 16 | 311 | 26 | 08.3 | 0 | 45 | 03.3 | | 31 | 308 | 11 | 34.1 | 0 | 48 | 31.9 |
| | 17 | 311 | 21 | 59.4 | 0 | 45 | 09.9 | Sept. | 1 | 308 | 08 | 02.4 | 0 | 48 | 34.2 |
| | 18 | 311 | 17 | 48.4 | 0 | 45 | 16.4 | | 2 | 308 | 04 | 34.5 | 0 | 48 | 36.4 |
| | 19 | 311 | 13 | 35.4 | -0 | 45 | 22.8 | | 3 | 308 | 01 | 10.4 | -0 | 48 | 38.5 |
| | 20 | 311 | 09 | 20.6 | 0 | 45 | 29.2 | | 4 | 307 | 57 | 50.3 | 0 | 48 | 40.6 |
| | 21 | 311 | 05 | 04.1 | 0 | 45 | 35.5 | | 5 | 307 | 54 | 34.1 | 0 | 48 | 42.6 |
| | 22 | 311 | 00 | 46.0 | 0 | 45 | 41.6 | | 6 | 307 | 51 | 22.1 | 0 | 48 | 44.5 |
| | 23 | 310 | 56 | 26.5 | 0 | 45 | 47.7 | | 7 | 307 | 48 | 14.3 | 0 | 48 | 46.3 |
| | 24 | 310 | 52 | 05.5 | 0 | 45 | 53.7 | | 8 | 307 | 45 | 10.8 | 0 | 48 | 48.0 |
| | 25 | 310 | 47 | 43.2 | -0 | 45 | 59.7 | | 9 | 307 | 42 | 11.8 | -0 | 48 | 49.7 |
| | 26 | 310 | 43 | 19.8 | 0 | 46 | 05.5 | | 10 | 307 | 39 | 17.3 | 0 | 48 | 51.3 |
| | 27 | 310 | 38 | 55.2 | 0 | 46 | 11.2 | | 11 | 307 | 36 | 27.5 | 0 | 48 | 52.8 |
| | 28 | 310 | 34 | 29.8 | 0 | 46 | 16.9 | | 12 | 307 | 33 | 42.5 | 0 | 48 | 54.2 |
| | 29 | 310 | 30 | 03.5 | 0 | 46 | 22.4 | | 13 | 307 | 31 | 02.4 | 0 | 48 | 55.6 |
| | 30 | 310 | 25 | 36.7 | 0 | 46 | 27.8 | | 14 | 307 | 28 | 27.3 | 0 | 48 | 56.8 |
| | 31 | 310 | 21 | 09.4 | -0 | 46 | 33.2 | | 15 | 307 | 25 | 57.1 | -0 | 48 | 58.1 |
| Aug. | 1 | 310 | 16 | 41.7 | 0 | 46 | 38.5 | | 16 | 307 | 23 | 31.9 | 0 | 48 | 59.2 |
| | 2 | 310 | 12 | 13.9 | 0 | 46 | 43.6 | | 17 | 307 | 21 | 11.7 | 0 | 49 | 00.3 |
| | 3 | 310 | 07 | 46.0 | 0 | 46 | 48.7 | | 18 | 307 | 18 | 56.6 | 0 | 49 | 01.3 |
| | 4 | 310 | 03 | 18.3 | 0 | 46 | 53.7 | | 19 | 307 | 16 | 46.7 | 0 | 49 | 02.2 |
| | 5 | 309 | 58 | 50.7 | 0 | 46 | 58.5 | | 20 | 307 | 14 | 42.0 | 0 | 49 | 03.1 |
| | 6 | 309 | 54 | 23.5 | -0 | 47 | 03.3 | | 21 | 307 | 12 | 42.5 | -0 | 49 | 03.9 |
| | 7 | 309 | 49 | 56.8 | 0 | 47 | 08.0 | | 22 | 307 | 10 | 48.4 | 0 | 49 | 04.6 |
| | 8 | 309 | 45 | 30.7 | 0 | 47 | 12.6 | | 23 | 307 | 08 | 59.7 | 0 | 49 | 05.3 |
| | 9 | 309 | 41 | 05.3 | 0 | 47 | 17.1 | | 24 | 307 | 07 | 16.5 | 0 | 49 | 05.9 |
| | 10 | 309 | 36 | 40.8 | 0 | 47 | 21.5 | | 25 | 307 | 05 | 38.9 | 0 | 49 | 06.4 |
| | 11 | 309 | 32 | 17.3 | 0 | 47 | 25.8 | | 26 | 307 | 04 | 06.9 | 0 | 49 | 06.9 |
| | 12 | 309 | 27 | 55.0 | -0 | 47 | 30.0 | | 27 | 307 | 02 | 40.5 | -0 | 49 | 07.4 |
| | 13 | 309 | 23 | 34.0 | 0 | 47 | 34.2 | | 28 | 307 | 01 | 19.8 | 0 | 49 | 07.8 |
| | 14 | 309 | 19 | 14.6 | 0 | 47 | 38.2 | | 29 | 307 | 00 | 04.8 | 0 | 49 | 08.1 |
| | 15 | 309 | 14 | 56.8 | 0 | 47 | 42.1 | | 30 | 306 | 58 | 55.6 | 0 | 49 | 08.4 |
| | 16 | 309 | 10 | 40.9 | -0 | 47 | 46.0 | Oct. | 1 | 306 | 57 | 52.2 | -0 | 49 | 08.6 |

**SATURN, 2021**
GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| Oct. | 1 | 306 | 57 | 52.2 | -0 | 49 | 08.6 | Nov. | 16 | 307 | 56 | 34.8 | -0 | 48 | 56.8 |
| | 2 | 306 | 56 | 54.6 | 0 | 49 | 08.8 | | 17 | 308 | 00 | 06.1 | 0 | 48 | 56.5 |
| | 3 | 306 | 56 | 02.8 | 0 | 49 | 09.0 | | 18 | 308 | 03 | 42.5 | 0 | 48 | 56.3 |
| | 4 | 306 | 55 | 16.8 | 0 | 49 | 09.1 | | 19 | 308 | 07 | 24.2 | 0 | 48 | 56.2 |
| | 5 | 306 | 54 | 36.8 | 0 | 49 | 09.2 | | 20 | 308 | 11 | 10.9 | 0 | 48 | 56.0 |
| | 6 | 306 | 54 | 02.7 | 0 | 49 | 09.3 | | 21 | 308 | 15 | 02.7 | 0 | 48 | 55.9 |
| | 7 | 306 | 53 | 34.6 | -0 | 49 | 09.3 | | 22 | 308 | 18 | 59.5 | -0 | 48 | 55.8 |
| | 8 | 306 | 53 | 12.6 | 0 | 49 | 09.2 | | 23 | 308 | 23 | 01.3 | 0 | 48 | 55.7 |
| | 9 | 306 | 52 | 56.7 | 0 | 49 | 09.2 | | 24 | 308 | 27 | 08.0 | 0 | 48 | 55.6 |
| | 10 | 306 | 52 | 46.9 | 0 | 49 | 09.1 | | 25 | 308 | 31 | 19.4 | 0 | 48 | 55.6 |
| | 11 | 306 | 52 | 43.3 | 0 | 49 | 09.0 | | 26 | 308 | 35 | 35.6 | 0 | 48 | 55.6 |
| | 12 | 306 | 52 | 45.7 | 0 | 49 | 08.8 | | 27 | 308 | 39 | 56.6 | 0 | 48 | 55.7 |
| | 13 | 306 | 52 | 54.3 | -0 | 49 | 08.7 | | 28 | 308 | 44 | 22.1 | -0 | 48 | 55.8 |
| | 14 | 306 | 53 | 08.8 | 0 | 49 | 08.5 | | 29 | 308 | 48 | 52.3 | 0 | 48 | 55.9 |
| | 15 | 306 | 53 | 29.4 | 0 | 49 | 08.2 | | 30 | 308 | 53 | 27.1 | 0 | 48 | 56.1 |
| | 16 | 306 | 53 | 56.0 | 0 | 49 | 08.0 | Dec. | 1 | 308 | 58 | 06.4 | 0 | 48 | 56.3 |
| | 17 | 306 | 54 | 28.6 | 0 | 49 | 07.7 | | 2 | 309 | 02 | 50.3 | 0 | 48 | 56.5 |
| | 18 | 306 | 55 | 07.2 | 0 | 49 | 07.4 | | 3 | 309 | 07 | 38.6 | 0 | 48 | 56.8 |
| | 19 | 306 | 55 | 51.9 | -0 | 49 | 07.1 | | 4 | 309 | 12 | 31.4 | -0 | 48 | 57.1 |
| | 20 | 306 | 56 | 42.6 | 0 | 49 | 06.7 | | 5 | 309 | 17 | 28.5 | 0 | 48 | 57.5 |
| | 21 | 306 | 57 | 39.3 | 0 | 49 | 06.4 | | 6 | 309 | 22 | 30.0 | 0 | 48 | 57.9 |
| | 22 | 306 | 58 | 42.1 | 0 | 49 | 06.0 | | 7 | 309 | 27 | 35.6 | 0 | 48 | 58.3 |
| | 23 | 306 | 59 | 50.9 | 0 | 49 | 05.6 | | 8 | 309 | 32 | 45.2 | 0 | 48 | 58.8 |
| | 24 | 307 | 01 | 05.7 | 0 | 49 | 05.2 | | 9 | 309 | 37 | 58.8 | 0 | 48 | 59.3 |
| | 25 | 307 | 02 | 26.5 | -0 | 49 | 04.8 | | 10 | 309 | 43 | 16.3 | -0 | 48 | 59.9 |
| | 26 | 307 | 03 | 53.4 | 0 | 49 | 04.4 | | 11 | 309 | 48 | 37.6 | 0 | 49 | 00.5 |
| | 27 | 307 | 05 | 26.2 | 0 | 49 | 04.0 | | 12 | 309 | 54 | 02.7 | 0 | 49 | 01.1 |
| | 28 | 307 | 07 | 04.9 | 0 | 49 | 03.6 | | 13 | 309 | 59 | 31.6 | 0 | 49 | 01.8 |
| | 29 | 307 | 08 | 49.5 | 0 | 49 | 03.1 | | 14 | 310 | 05 | 04.2 | 0 | 49 | 02.6 |
| | 30 | 307 | 10 | 40.0 | 0 | 49 | 02.7 | | 15 | 310 | 10 | 40.4 | 0 | 49 | 03.3 |
| | 31 | 307 | 12 | 36.3 | -0 | 49 | 02.3 | | 16 | 310 | 16 | 20.2 | -0 | 49 | 04.2 |
| Nov. | 1 | 307 | 14 | 38.4 | 0 | 49 | 01.9 | | 17 | 310 | 22 | 03.6 | 0 | 49 | 05.0 |
| | 2 | 307 | 16 | 46.4 | 0 | 49 | 01.5 | | 18 | 310 | 27 | 50.4 | 0 | 49 | 06.0 |
| | 3 | 307 | 19 | 00.2 | 0 | 49 | 01.1 | | 19 | 310 | 33 | 40.6 | 0 | 49 | 06.9 |
| | 4 | 307 | 21 | 19.8 | 0 | 49 | 00.7 | | 20 | 310 | 39 | 34.1 | 0 | 49 | 08.0 |
| | 5 | 307 | 23 | 45.2 | 0 | 49 | 00.3 | | 21 | 310 | 45 | 30.8 | 0 | 49 | 09.0 |
| | 6 | 307 | 26 | 16.5 | -0 | 48 | 59.9 | | 22 | 310 | 51 | 30.7 | -0 | 49 | 10.2 |
| | 7 | 307 | 28 | 53.5 | 0 | 48 | 59.5 | | 23 | 310 | 57 | 33.7 | 0 | 49 | 11.4 |
| | 8 | 307 | 31 | 36.2 | 0 | 48 | 59.2 | | 24 | 311 | 03 | 39.7 | 0 | 49 | 12.6 |
| | 9 | 307 | 34 | 24.5 | 0 | 48 | 58.8 | | 25 | 311 | 09 | 48.6 | 0 | 49 | 13.9 |
| | 10 | 307 | 37 | 18.4 | 0 | 48 | 58.5 | | 26 | 311 | 16 | 00.4 | 0 | 49 | 15.3 |
| | 11 | 307 | 40 | 17.7 | 0 | 48 | 58.2 | | 27 | 311 | 22 | 15.1 | 0 | 49 | 16.7 |
| | 12 | 307 | 43 | 22.5 | -0 | 48 | 57.9 | | 28 | 311 | 28 | 32.6 | -0 | 49 | 18.1 |
| | 13 | 307 | 46 | 32.6 | 0 | 48 | 57.6 | | 29 | 311 | 34 | 52.8 | 0 | 49 | 19.7 |
| | 14 | 307 | 49 | 48.0 | 0 | 48 | 57.3 | | 30 | 311 | 41 | 15.8 | 0 | 49 | 21.3 |
| | 15 | 307 | 53 | 08.8 | 0 | 48 | 57.0 | | 31 | 311 | 47 | 41.5 | 0 | 49 | 22.9 |
| | 16 | 307 | 56 | 34.8 | -0 | 48 | 56.8 | | 32 | 311 | 54 | 09.7 | -0 | 49 | 24.6 |

**SATURN, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Jan. | 0 | 20 | 15 | 22.00 | -20 | 11 | 56.1 | 10.893 761 | 0.81 | 6.78 | 13 | 33 | 53 |
| | 1 | 20 | 15 | 50.39 | 20 | 10 | 28.8 | 10.899 752 | 0.81 | 6.77 | 13 | 30 | 26 |
| | 2 | 20 | 16 | 18.89 | 20 | 09 | 00.9 | 10.905 499 | 0.81 | 6.77 | 13 | 26 | 58 |
| | 3 | 20 | 16 | 47.48 | 20 | 07 | 32.4 | 10.911 000 | 0.81 | 6.77 | 13 | 23 | 31 |
| | 4 | 20 | 17 | 16.16 | 20 | 06 | 03.3 | 10.916 254 | 0.81 | 6.76 | 13 | 20 | 04 |
| | 5 | 20 | 17 | 44.93 | 20 | 04 | 33.7 | 10.921 259 | 0.81 | 6.76 | 13 | 16 | 36 |
| | 6 | 20 | 18 | 13.78 | -20 | 03 | 03.4 | 10.926 014 | 0.80 | 6.76 | 13 | 13 | 09 |
| | 7 | 20 | 18 | 42.72 | 20 | 01 | 32.6 | 10.930 519 | 0.80 | 6.75 | 13 | 09 | 42 |
| | 8 | 20 | 19 | 11.74 | 20 | 00 | 01.3 | 10.934 770 | 0.80 | 6.75 | 13 | 06 | 15 |
| | 9 | 20 | 19 | 40.83 | 19 | 58 | 29.4 | 10.938 767 | 0.80 | 6.75 | 13 | 02 | 48 |
| | 10 | 20 | 20 | 09.99 | 19 | 56 | 56.9 | 10.942 509 | 0.80 | 6.75 | 12 | 59 | 21 |
| | 11 | 20 | 20 | 39.22 | 19 | 55 | 24.0 | 10.945 994 | 0.80 | 6.74 | 12 | 55 | 54 |
| | 12 | 20 | 21 | 08.51 | -19 | 53 | 50.6 | 10.949 221 | 0.80 | 6.74 | 12 | 52 | 28 |
| | 13 | 20 | 21 | 37.84 | 19 | 52 | 16.8 | 10.952 189 | 0.80 | 6.74 | 12 | 49 | 01 |
| | 14 | 20 | 22 | 07.23 | 19 | 50 | 42.5 | 10.954 898 | 0.80 | 6.74 | 12 | 45 | 34 |
| | 15 | 20 | 22 | 36.64 | 19 | 49 | 07.9 | 10.957 347 | 0.80 | 6.74 | 12 | 42 | 08 |
| | 16 | 20 | 23 | 06.09 | 19 | 47 | 32.8 | 10.959 535 | 0.80 | 6.74 | 12 | 38 | 41 |
| | 17 | 20 | 23 | 35.57 | 19 | 45 | 57.3 | 10.961 462 | 0.80 | 6.73 | 12 | 35 | 15 |
| | 18 | 20 | 24 | 05.06 | -19 | 44 | 21.5 | 10.963 128 | 0.80 | 6.73 | 12 | 31 | 48 |
| | 19 | 20 | 24 | 34.58 | 19 | 42 | 45.3 | 10.964 533 | 0.80 | 6.73 | 12 | 28 | 21 |
| | 20 | 20 | 25 | 04.11 | 19 | 41 | 08.7 | 10.965 677 | 0.80 | 6.73 | 12 | 24 | 55 |
| | 21 | 20 | 25 | 33.65 | 19 | 39 | 31.8 | 10.966 560 | 0.80 | 6.73 | 12 | 21 | 28 |
| | 22 | 20 | 26 | 03.20 | 19 | 37 | 54.5 | 10.967 182 | 0.80 | 6.73 | 12 | 18 | 02 |
| | 23 | 20 | 26 | 32.76 | 19 | 36 | 17.0 | 10.967 543 | 0.80 | 6.73 | 12 | 14 | 35 |
| | 24 | 20 | 27 | 02.31 | -19 | 34 | 40.0 | 10.967 644 | 0.80 | 6.73 | 12 | 11 | 09 |
| | 25 | 20 | 27 | 31.79 | 19 | 33 | 01.4 | 10.967 484 | 0.80 | 6.73 | 12 | 07 | 42 |
| | 26 | 20 | 28 | 01.32 | 19 | 31 | 22.8 | 10.967 065 | 0.80 | 6.73 | 12 | 04 | 16 |
| | 27 | 20 | 28 | 30.84 | 19 | 29 | 44.2 | 10.966 386 | 0.80 | 6.73 | 12 | 00 | 49 |
| | 28 | 20 | 29 | 00.32 | 19 | 28 | 05.5 | 10.965 448 | 0.80 | 6.73 | 11 | 57 | 23 |
| | 29 | 20 | 29 | 29.78 | 19 | 26 | 26.6 | 10.964 252 | 0.80 | 6.73 | 11 | 53 | 56 |
| | 30 | 20 | 29 | 59.20 | -19 | 24 | 47.5 | 10.962 797 | 0.80 | 6.73 | 11 | 50 | 29 |
| | 31 | 20 | 30 | 28.58 | 19 | 23 | 08.3 | 10.961 084 | 0.80 | 6.73 | 11 | 47 | 03 |
| Feb. | 1 | 20 | 30 | 57.92 | 19 | 21 | 28.9 | 10.959 114 | 0.80 | 6.74 | 11 | 43 | 36 |
| | 2 | 20 | 31 | 27.21 | 19 | 19 | 49.5 | 10.956 886 | 0.80 | 6.74 | 11 | 40 | 09 |
| | 3 | 20 | 31 | 56.46 | 19 | 18 | 09.8 | 10.954 400 | 0.80 | 6.74 | 11 | 36 | 42 |
| | 4 | 20 | 32 | 25.65 | 19 | 16 | 30.1 | 10.951 658 | 0.80 | 6.74 | 11 | 33 | 15 |
| | 5 | 20 | 32 | 54.79 | -19 | 14 | 50.3 | 10.948 660 | 0.80 | 6.74 | 11 | 29 | 48 |
| | 6 | 20 | 33 | 23.86 | 19 | 13 | 10.4 | 10.945 404 | 0.80 | 6.74 | 11 | 26 | 21 |
| | 7 | 20 | 33 | 52.88 | 19 | 11 | 30.5 | 10.941 893 | 0.80 | 6.75 | 11 | 22 | 54 |
| | 8 | 20 | 34 | 21.83 | 19 | 09 | 50.6 | 10.938 127 | 0.80 | 6.75 | 11 | 19 | 27 |
| | 9 | 20 | 34 | 50.69 | 19 | 08 | 10.7 | 10.934 106 | 0.80 | 6.75 | 11 | 15 | 60 |
| | 10 | 20 | 35 | 19.48 | 19 | 06 | 30.8 | 10.929 831 | 0.80 | 6.75 | 11 | 12 | 33 |
| | 11 | 20 | 35 | 48.17 | -19 | 04 | 51.1 | 10.925 303 | 0.80 | 6.76 | 11 | 09 | 05 |
| | 12 | 20 | 36 | 16.77 | 19 | 03 | 11.4 | 10.920 523 | 0.81 | 6.76 | 11 | 05 | 38 |
| | 13 | 20 | 36 | 45.27 | 19 | 01 | 31.8 | 10.915 493 | 0.81 | 6.76 | 11 | 02 | 10 |
| | 14 | 20 | 37 | 13.66 | 18 | 59 | 52.4 | 10.910 213 | 0.81 | 6.77 | 10 | 58 | 42 |
| | 15 | 20 | 37 | 41.94 | -18 | 58 | 13.0 | 10.904 686 | 0.81 | 6.77 | 10 | 55 | 15 |

**SATURN, 2021**

RIGHT ASCENSION AND DECLINATION FOR 0$^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Feb. | 15 | 20 | 37 | 41.94 | -18 | 58 | 13.0 | 10.904 686 | 0.81 | 6.77 | 10 | 55 | 15 |
| | 16 | 20 | 38 | 10.12 | 18 | 56 | 33.8 | 10.898 914 | 0.81 | 6.77 | 10 | 51 | 47 |
| | 17 | 20 | 38 | 38.17 | 18 | 54 | 54.8 | 10.892 897 | 0.81 | 6.78 | 10 | 48 | 19 |
| | 18 | 20 | 39 | 06.11 | 18 | 53 | 16.0 | 10.886 637 | 0.81 | 6.78 | 10 | 44 | 50 |
| | 19 | 20 | 39 | 33.92 | 18 | 51 | 37.3 | 10.880 137 | 0.81 | 6.78 | 10 | 41 | 22 |
| | 20 | 20 | 40 | 01.60 | 18 | 49 | 58.9 | 10.873 398 | 0.81 | 6.79 | 10 | 37 | 54 |
| | 21 | 20 | 40 | 29.16 | -18 | 48 | 20.8 | 10.866 421 | 0.81 | 6.79 | 10 | 34 | 25 |
| | 22 | 20 | 40 | 56.58 | 18 | 46 | 43.0 | 10.859 210 | 0.81 | 6.80 | 10 | 30 | 56 |
| | 23 | 20 | 41 | 23.85 | 18 | 45 | 05.4 | 10.851 766 | 0.81 | 6.80 | 10 | 27 | 28 |
| | 24 | 20 | 41 | 50.98 | 18 | 43 | 28.2 | 10.844 091 | 0.81 | 6.81 | 10 | 23 | 59 |
| | 25 | 20 | 42 | 17.96 | 18 | 41 | 51.4 | 10.836 187 | 0.81 | 6.81 | 10 | 20 | 29 |
| | 26 | 20 | 42 | 44.78 | 18 | 40 | 15.0 | 10.828 055 | 0.81 | 6.82 | 10 | 17 | 00 |
| | 27 | 20 | 43 | 11.43 | -18 | 38 | 38.9 | 10.819 699 | 0.81 | 6.82 | 10 | 13 | 31 |
| | 28 | 20 | 43 | 37.93 | 18 | 37 | 03.3 | 10.811 119 | 0.81 | 6.83 | 10 | 10 | 01 |
| Mar. | 1 | 20 | 44 | 04.25 | 18 | 35 | 28.1 | 10.802 318 | 0.81 | 6.83 | 10 | 06 | 31 |
| | 2 | 20 | 44 | 30.40 | 18 | 33 | 53.4 | 10.793 298 | 0.81 | 6.84 | 10 | 03 | 01 |
| | 3 | 20 | 44 | 56.39 | 18 | 32 | 19.0 | 10.784 060 | 0.82 | 6.85 | 9 | 59 | 31 |
| | 4 | 20 | 45 | 22.19 | 18 | 30 | 45.2 | 10.774 605 | 0.82 | 6.85 | 9 | 56 | 01 |
| | 5 | 20 | 45 | 47.82 | -18 | 29 | 11.8 | 10.764 937 | 0.82 | 6.86 | 9 | 52 | 30 |
| | 6 | 20 | 46 | 13.27 | 18 | 27 | 38.9 | 10.755 056 | 0.82 | 6.86 | 9 | 48 | 60 |
| | 7 | 20 | 46 | 38.53 | 18 | 26 | 06.6 | 10.744 964 | 0.82 | 6.87 | 9 | 45 | 29 |
| | 8 | 20 | 47 | 03.59 | 18 | 24 | 34.9 | 10.734 665 | 0.82 | 6.88 | 9 | 41 | 58 |
| | 9 | 20 | 47 | 28.45 | 18 | 23 | 03.9 | 10.724 160 | 0.82 | 6.88 | 9 | 38 | 27 |
| | 10 | 20 | 47 | 53.11 | 18 | 21 | 33.4 | 10.713 451 | 0.82 | 6.89 | 9 | 34 | 55 |
| | 11 | 20 | 48 | 17.55 | -18 | 20 | 03.7 | 10.702 541 | 0.82 | 6.90 | 9 | 31 | 23 |
| | 12 | 20 | 48 | 41.77 | 18 | 18 | 34.6 | 10.691 433 | 0.82 | 6.90 | 9 | 27 | 52 |
| | 13 | 20 | 49 | 05.78 | 18 | 17 | 06.2 | 10.680 130 | 0.82 | 6.91 | 9 | 24 | 19 |
| | 14 | 20 | 49 | 29.56 | 18 | 15 | 38.5 | 10.668 634 | 0.82 | 6.92 | 9 | 20 | 47 |
| | 15 | 20 | 49 | 53.11 | 18 | 14 | 11.5 | 10.656 948 | 0.83 | 6.93 | 9 | 17 | 15 |
| | 16 | 20 | 50 | 16.44 | 18 | 12 | 45.3 | 10.645 076 | 0.83 | 6.93 | 9 | 13 | 42 |
| | 17 | 20 | 50 | 39.52 | -18 | 11 | 19.8 | 10.633 021 | 0.83 | 6.94 | 9 | 10 | 09 |
| | 18 | 20 | 51 | 02.38 | 18 | 09 | 55.2 | 10.620 785 | 0.83 | 6.95 | 9 | 06 | 35 |
| | 19 | 20 | 51 | 24.99 | 18 | 08 | 31.3 | 10.608 373 | 0.83 | 6.96 | 9 | 03 | 02 |
| | 20 | 20 | 51 | 47.36 | 18 | 07 | 08.3 | 10.595 786 | 0.83 | 6.97 | 8 | 59 | 28 |
| | 21 | 20 | 52 | 09.48 | 18 | 05 | 46.2 | 10.583 030 | 0.83 | 6.98 | 8 | 55 | 54 |
| | 22 | 20 | 52 | 31.34 | 18 | 04 | 25.0 | 10.570 107 | 0.83 | 6.98 | 8 | 52 | 20 |
| | 23 | 20 | 52 | 52.95 | -18 | 03 | 04.7 | 10.557 019 | 0.83 | 6.99 | 8 | 48 | 45 |
| | 24 | 20 | 53 | 14.30 | 18 | 01 | 45.3 | 10.543 772 | 0.83 | 7.00 | 8 | 45 | 11 |
| | 25 | 20 | 53 | 35.39 | 18 | 00 | 27.0 | 10.530 368 | 0.84 | 7.01 | 8 | 41 | 36 |
| | 26 | 20 | 53 | 56.20 | 17 | 59 | 09.6 | 10.516 809 | 0.84 | 7.02 | 8 | 38 | 00 |
| | 27 | 20 | 54 | 16.74 | 17 | 57 | 53.2 | 10.503 101 | 0.84 | 7.03 | 8 | 34 | 25 |
| | 28 | 20 | 54 | 37.00 | 17 | 56 | 37.8 | 10.489 245 | 0.84 | 7.04 | 8 | 30 | 49 |
| | 29 | 20 | 54 | 56.98 | -17 | 55 | 23.5 | 10.475 245 | 0.84 | 7.05 | 8 | 27 | 13 |
| | 30 | 20 | 55 | 16.69 | 17 | 54 | 10.1 | 10.461 105 | 0.84 | 7.06 | 8 | 23 | 36 |
| | 31 | 20 | 55 | 36.11 | 17 | 52 | 57.8 | 10.446 826 | 0.84 | 7.07 | 8 | 19 | 60 |
| Apr. | 1 | 20 | 55 | 55.25 | 17 | 51 | 46.6 | 10.432 412 | 0.84 | 7.08 | 8 | 16 | 23 |
| | 2 | 20 | 56 | 14.11 | -17 | 50 | 36.5 | 10.417 866 | 0.84 | 7.09 | 8 | 12 | 46 |

**SATURN, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Apr. | 1 | 20 | 55 | 55.25 | -17 | 51 | 46.6 | 10.432 412 | 0.84 | 7.08 | 8 | 16 | 23 |
| | 2 | 20 | 56 | 14.11 | 17 | 50 | 36.5 | 10.417 866 | 0.84 | 7.09 | 8 | 12 | 46 |
| | 3 | 20 | 56 | 32.68 | 17 | 49 | 27.4 | 10.403 192 | 0.85 | 7.10 | 8 | 09 | 08 |
| | 4 | 20 | 56 | 50.95 | 17 | 48 | 19.6 | 10.388 392 | 0.85 | 7.11 | 8 | 05 | 30 |
| | 5 | 20 | 57 | 08.91 | 17 | 47 | 12.9 | 10.373 469 | 0.85 | 7.12 | 8 | 01 | 52 |
| | 6 | 20 | 57 | 26.57 | 17 | 46 | 07.5 | 10.358 429 | 0.85 | 7.13 | 7 | 58 | 14 |
| | 7 | 20 | 57 | 43.92 | -17 | 45 | 03.3 | 10.343 273 | 0.85 | 7.14 | 7 | 54 | 35 |
| | 8 | 20 | 58 | 00.95 | 17 | 44 | 00.3 | 10.328 006 | 0.85 | 7.15 | 7 | 50 | 56 |
| | 9 | 20 | 58 | 17.66 | 17 | 42 | 58.6 | 10.312 632 | 0.85 | 7.16 | 7 | 47 | 16 |
| | 10 | 20 | 58 | 34.05 | 17 | 41 | 58.1 | 10.297 155 | 0.85 | 7.17 | 7 | 43 | 37 |
| | 11 | 20 | 58 | 50.12 | 17 | 40 | 59.0 | 10.281 579 | 0.86 | 7.18 | 7 | 39 | 57 |
| | 12 | 20 | 59 | 05.85 | 17 | 40 | 01.1 | 10.265 908 | 0.86 | 7.19 | 7 | 36 | 16 |
| | 13 | 20 | 59 | 21.26 | -17 | 39 | 04.5 | 10.250 146 | 0.86 | 7.20 | 7 | 32 | 36 |
| | 14 | 20 | 59 | 36.34 | 17 | 38 | 09.3 | 10.234 297 | 0.86 | 7.21 | 7 | 28 | 55 |
| | 15 | 20 | 59 | 51.09 | 17 | 37 | 15.4 | 10.218 366 | 0.86 | 7.22 | 7 | 25 | 13 |
| | 16 | 21 | 00 | 05.50 | 17 | 36 | 22.9 | 10.202 358 | 0.86 | 7.24 | 7 | 21 | 32 |
| | 17 | 21 | 00 | 19.57 | 17 | 35 | 31.8 | 10.186 275 | 0.86 | 7.25 | 7 | 17 | 50 |
| | 18 | 21 | 00 | 33.30 | 17 | 34 | 42.2 | 10.170 124 | 0.86 | 7.26 | 7 | 14 | 07 |
| | 19 | 21 | 00 | 46.68 | -17 | 33 | 53.9 | 10.153 907 | 0.87 | 7.27 | 7 | 10 | 24 |
| | 20 | 21 | 00 | 59.71 | 17 | 33 | 07.1 | 10.137 630 | 0.87 | 7.28 | 7 | 06 | 41 |
| | 21 | 21 | 01 | 12.39 | 17 | 32 | 21.8 | 10.121 296 | 0.87 | 7.29 | 7 | 02 | 58 |
| | 22 | 21 | 01 | 24.72 | 17 | 31 | 38.0 | 10.104 911 | 0.87 | 7.31 | 6 | 59 | 14 |
| | 23 | 21 | 01 | 36.68 | 17 | 30 | 55.7 | 10.088 478 | 0.87 | 7.32 | 6 | 55 | 30 |
| | 24 | 21 | 01 | 48.29 | 17 | 30 | 14.9 | 10.072 001 | 0.87 | 7.33 | 6 | 51 | 46 |
| | 25 | 21 | 01 | 59.53 | -17 | 29 | 35.6 | 10.055 484 | 0.87 | 7.34 | 6 | 48 | 01 |
| | 26 | 21 | 02 | 10.42 | 17 | 28 | 57.8 | 10.038 932 | 0.88 | 7.35 | 6 | 44 | 16 |
| | 27 | 21 | 02 | 20.94 | 17 | 28 | 21.5 | 10.022 349 | 0.88 | 7.37 | 6 | 40 | 30 |
| | 28 | 21 | 02 | 31.11 | 17 | 27 | 46.7 | 10.005 737 | 0.88 | 7.38 | 6 | 36 | 44 |
| | 29 | 21 | 02 | 40.91 | 17 | 27 | 13.4 | 9.989 102 | 0.88 | 7.39 | 6 | 32 | 58 |
| | 30 | 21 | 02 | 50.35 | 17 | 26 | 41.8 | 9.972 447 | 0.88 | 7.40 | 6 | 29 | 11 |
| May | 1 | 21 | 02 | 59.42 | -17 | 26 | 11.6 | 9.955 775 | 0.88 | 7.41 | 6 | 25 | 24 |
| | 2 | 21 | 03 | 08.11 | 17 | 25 | 43.1 | 9.939 092 | 0.88 | 7.43 | 6 | 21 | 37 |
| | 3 | 21 | 03 | 16.43 | 17 | 25 | 16.3 | 9.922 401 | 0.89 | 7.44 | 6 | 17 | 49 |
| | 4 | 21 | 03 | 24.37 | 17 | 24 | 51.1 | 9.905 707 | 0.89 | 7.45 | 6 | 14 | 01 |
| | 5 | 21 | 03 | 31.92 | 17 | 24 | 27.5 | 9.889 014 | 0.89 | 7.46 | 6 | 10 | 13 |
| | 6 | 21 | 03 | 39.09 | 17 | 24 | 05.5 | 9.872 326 | 0.89 | 7.48 | 6 | 06 | 24 |
| | 7 | 21 | 03 | 45.87 | -17 | 23 | 45.2 | 9.855 649 | 0.89 | 7.49 | 6 | 02 | 35 |
| | 8 | 21 | 03 | 52.26 | 17 | 23 | 26.6 | 9.838 987 | 0.89 | 7.50 | 5 | 58 | 45 |
| | 9 | 21 | 03 | 58.27 | 17 | 23 | 09.5 | 9.822 345 | 0.90 | 7.52 | 5 | 54 | 55 |
| | 10 | 21 | 04 | 03.89 | 17 | 22 | 54.2 | 9.805 727 | 0.90 | 7.53 | 5 | 51 | 04 |
| | 11 | 21 | 04 | 09.12 | 17 | 22 | 40.5 | 9.789 139 | 0.90 | 7.54 | 5 | 47 | 14 |
| | 12 | 21 | 04 | 13.96 | 17 | 22 | 28.5 | 9.772 585 | 0.90 | 7.55 | 5 | 43 | 22 |
| | 13 | 21 | 04 | 18.41 | -17 | 22 | 18.1 | 9.756 070 | 0.90 | 7.57 | 5 | 39 | 31 |
| | 14 | 21 | 04 | 22.48 | 17 | 22 | 09.5 | 9.739 599 | 0.90 | 7.58 | 5 | 35 | 39 |
| | 15 | 21 | 04 | 26.15 | 17 | 22 | 02.5 | 9.723 177 | 0.90 | 7.59 | 5 | 31 | 47 |
| | 16 | 21 | 04 | 29.43 | 17 | 21 | 57.3 | 9.706 808 | 0.91 | 7.60 | 5 | 27 | 54 |
| | 17 | 21 | 04 | 32.31 | -17 | 21 | 53.7 | 9.690 498 | 0.91 | 7.62 | 5 | 24 | 01 |

**SATURN, 2021**
RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| May | 17 | 21 | 04 | 32.31 | -17 | 21 | 53.7 | 9.690 498 | 0.91 | 7.62 | 5 | 24 | 01 |
| | 18 | 21 | 04 | 34.80 | 17 | 21 | 51.9 | 9.674 251 | 0.91 | 7.63 | 5 | 20 | 07 |
| | 19 | 21 | 04 | 36.90 | 17 | 21 | 51.8 | 9.658 072 | 0.91 | 7.64 | 5 | 16 | 13 |
| | 20 | 21 | 04 | 38.60 | 17 | 21 | 53.5 | 9.641 965 | 0.91 | 7.66 | 5 | 12 | 19 |
| | 21 | 21 | 04 | 39.90 | 17 | 21 | 56.8 | 9.625 935 | 0.91 | 7.67 | 5 | 08 | 24 |
| | 22 | 21 | 04 | 40.81 | 17 | 22 | 01.8 | 9.609 987 | 0.92 | 7.68 | 5 | 04 | 29 |
| | 23 | 21 | 04 | 41.33 | -17 | 22 | 08.5 | 9.594 124 | 0.92 | 7.69 | 5 | 00 | 34 |
| | 24 | 21 | 04 | 41.46 | 17 | 22 | 16.8 | 9.578 351 | 0.92 | 7.71 | 4 | 56 | 38 |
| | 25 | 21 | 04 | 41.20 | 17 | 22 | 26.8 | 9.562 673 | 0.92 | 7.72 | 4 | 52 | 42 |
| | 26 | 21 | 04 | 40.56 | 17 | 22 | 38.4 | 9.547 092 | 0.92 | 7.73 | 4 | 48 | 45 |
| | 27 | 21 | 04 | 39.53 | 17 | 22 | 51.7 | 9.531 613 | 0.92 | 7.74 | 4 | 44 | 48 |
| | 28 | 21 | 04 | 38.12 | 17 | 23 | 06.7 | 9.516 241 | 0.92 | 7.76 | 4 | 40 | 51 |
| | 29 | 21 | 04 | 36.32 | -17 | 23 | 23.3 | 9.500 979 | 0.93 | 7.77 | 4 | 36 | 53 |
| | 30 | 21 | 04 | 34.14 | 17 | 23 | 41.7 | 9.485 832 | 0.93 | 7.78 | 4 | 32 | 55 |
| | 31 | 21 | 04 | 31.56 | 17 | 24 | 01.7 | 9.470 803 | 0.93 | 7.79 | 4 | 28 | 56 |
| June | 1 | 21 | 04 | 28.60 | 17 | 24 | 23.3 | 9.455 898 | 0.93 | 7.81 | 4 | 24 | 57 |
| | 2 | 21 | 04 | 25.25 | 17 | 24 | 46.6 | 9.441 121 | 0.93 | 7.82 | 4 | 20 | 58 |
| | 3 | 21 | 04 | 21.51 | 17 | 25 | 11.6 | 9.426 476 | 0.93 | 7.83 | 4 | 16 | 58 |
| | 4 | 21 | 04 | 17.38 | -17 | 25 | 38.1 | 9.411 968 | 0.93 | 7.84 | 4 | 12 | 58 |
| | 5 | 21 | 04 | 12.88 | 17 | 26 | 06.2 | 9.397 602 | 0.94 | 7.86 | 4 | 08 | 58 |
| | 6 | 21 | 04 | 08.00 | 17 | 26 | 35.9 | 9.383 383 | 0.94 | 7.87 | 4 | 04 | 57 |
| | 7 | 21 | 04 | 02.74 | 17 | 27 | 07.2 | 9.369 314 | 0.94 | 7.88 | 4 | 00 | 56 |
| | 8 | 21 | 03 | 57.11 | 17 | 27 | 40.1 | 9.355 400 | 0.94 | 7.89 | 3 | 56 | 54 |
| | 9 | 21 | 03 | 51.12 | 17 | 28 | 14.5 | 9.341 647 | 0.94 | 7.90 | 3 | 52 | 52 |
| | 10 | 21 | 03 | 44.75 | -17 | 28 | 50.4 | 9.328 059 | 0.94 | 7.91 | 3 | 48 | 50 |
| | 11 | 21 | 03 | 38.03 | 17 | 29 | 27.8 | 9.314 639 | 0.94 | 7.93 | 3 | 44 | 47 |
| | 12 | 21 | 03 | 30.94 | 17 | 30 | 06.8 | 9.301 393 | 0.95 | 7.94 | 3 | 40 | 44 |
| | 13 | 21 | 03 | 23.49 | 17 | 30 | 47.3 | 9.288 325 | 0.95 | 7.95 | 3 | 36 | 41 |
| | 14 | 21 | 03 | 15.68 | 17 | 31 | 29.2 | 9.275 439 | 0.95 | 7.96 | 3 | 32 | 37 |
| | 15 | 21 | 03 | 07.53 | 17 | 32 | 12.6 | 9.262 739 | 0.95 | 7.97 | 3 | 28 | 33 |
| | 16 | 21 | 02 | 59.02 | -17 | 32 | 57.5 | 9.250 230 | 0.95 | 7.98 | 3 | 24 | 28 |
| | 17 | 21 | 02 | 50.16 | 17 | 33 | 43.8 | 9.237 915 | 0.95 | 7.99 | 3 | 20 | 24 |
| | 18 | 21 | 02 | 40.97 | 17 | 34 | 31.4 | 9.225 798 | 0.95 | 8.00 | 3 | 16 | 19 |
| | 19 | 21 | 02 | 31.43 | 17 | 35 | 20.4 | 9.213 883 | 0.95 | 8.01 | 3 | 12 | 13 |
| | 20 | 21 | 02 | 21.57 | 17 | 36 | 10.7 | 9.202 173 | 0.96 | 8.02 | 3 | 08 | 07 |
| | 21 | 21 | 02 | 11.39 | 17 | 37 | 02.3 | 9.190 672 | 0.96 | 8.03 | 3 | 04 | 01 |
| | 22 | 21 | 02 | 00.89 | -17 | 37 | 55.2 | 9.179 383 | 0.96 | 8.04 | 2 | 59 | 55 |
| | 23 | 21 | 01 | 50.08 | 17 | 38 | 49.2 | 9.168 309 | 0.96 | 8.05 | 2 | 55 | 48 |
| | 24 | 21 | 01 | 38.96 | 17 | 39 | 44.5 | 9.157 454 | 0.96 | 8.06 | 2 | 51 | 41 |
| | 25 | 21 | 01 | 27.54 | 17 | 40 | 41.0 | 9.146 820 | 0.96 | 8.07 | 2 | 47 | 34 |
| | 26 | 21 | 01 | 15.82 | 17 | 41 | 38.7 | 9.136 411 | 0.96 | 8.08 | 2 | 43 | 26 |
| | 27 | 21 | 01 | 03.80 | 17 | 42 | 37.6 | 9.126 229 | 0.96 | 8.09 | 2 | 39 | 18 |
| | 28 | 21 | 00 | 51.48 | -17 | 43 | 37.6 | 9.116 279 | 0.96 | 8.10 | 2 | 35 | 10 |
| | 29 | 21 | 00 | 38.88 | 17 | 44 | 38.7 | 9.106 564 | 0.97 | 8.11 | 2 | 31 | 02 |
| | 30 | 21 | 00 | 25.99 | 17 | 45 | 40.9 | 9.097 086 | 0.97 | 8.11 | 2 | 26 | 53 |
| July | 1 | 21 | 00 | 12.82 | 17 | 46 | 44.1 | 9.087 849 | 0.97 | 8.12 | 2 | 22 | 44 |
| | 2 | 20 | 59 | 59.37 | -17 | 47 | 48.4 | 9.078 858 | 0.97 | 8.13 | 2 | 18 | 35 |

**SATURN, 2021**
RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| July | 1 | 21 | 00 | 12.82 | -17 | 46 | 44.1 | 9.087 849 | 0.97 | 8.12 | 2 | 22 | 44 |
| | 2 | 20 | 59 | 59.37 | 17 | 47 | 48.4 | 9.078 858 | 0.97 | 8.13 | 2 | 18 | 35 |
| | 3 | 20 | 59 | 45.67 | 17 | 48 | 53.5 | 9.070 114 | 0.97 | 8.14 | 2 | 14 | 25 |
| | 4 | 20 | 59 | 31.71 | 17 | 49 | 59.6 | 9.061 621 | 0.97 | 8.15 | 2 | 10 | 15 |
| | 5 | 20 | 59 | 17.50 | 17 | 51 | 06.7 | 9.053 383 | 0.97 | 8.15 | 2 | 06 | 05 |
| | 6 | 20 | 59 | 03.05 | 17 | 52 | 14.5 | 9.045 403 | 0.97 | 8.16 | 2 | 01 | 55 |
| | 7 | 20 | 58 | 48.36 | -17 | 53 | 23.3 | 9.037 683 | 0.97 | 8.17 | 1 | 57 | 44 |
| | 8 | 20 | 58 | 33.44 | 17 | 54 | 32.8 | 9.030 226 | 0.97 | 8.17 | 1 | 53 | 34 |
| | 9 | 20 | 58 | 18.30 | 17 | 55 | 43.1 | 9.023 036 | 0.97 | 8.18 | 1 | 49 | 23 |
| | 10 | 20 | 58 | 02.95 | 17 | 56 | 54.2 | 9.016 115 | 0.98 | 8.19 | 1 | 45 | 11 |
| | 11 | 20 | 57 | 47.39 | 17 | 58 | 05.9 | 9.009 466 | 0.98 | 8.19 | 1 | 41 | 00 |
| | 12 | 20 | 57 | 31.63 | 17 | 59 | 18.4 | 9.003 091 | 0.98 | 8.20 | 1 | 36 | 48 |
| | 13 | 20 | 57 | 15.67 | -18 | 00 | 31.5 | 8.996 992 | 0.98 | 8.20 | 1 | 32 | 37 |
| | 14 | 20 | 56 | 59.53 | 18 | 01 | 45.2 | 8.991 171 | 0.98 | 8.21 | 1 | 28 | 25 |
| | 15 | 20 | 56 | 43.20 | 18 | 02 | 59.5 | 8.985 631 | 0.98 | 8.22 | 1 | 24 | 13 |
| | 16 | 20 | 56 | 26.71 | 18 | 04 | 14.2 | 8.980 373 | 0.98 | 8.22 | 1 | 20 | 00 |
| | 17 | 20 | 56 | 10.07 | 18 | 05 | 29.4 | 8.975 399 | 0.98 | 8.22 | 1 | 15 | 48 |
| | 18 | 20 | 55 | 53.27 | 18 | 06 | 45.0 | 8.970 710 | 0.98 | 8.23 | 1 | 11 | 35 |
| | 19 | 20 | 55 | 36.34 | -18 | 08 | 01.0 | 8.966 307 | 0.98 | 8.23 | 1 | 07 | 22 |
| | 20 | 20 | 55 | 19.28 | 18 | 09 | 17.3 | 8.962 193 | 0.98 | 8.24 | 1 | 03 | 10 |
| | 21 | 20 | 55 | 02.11 | 18 | 10 | 33.9 | 8.958 366 | 0.98 | 8.24 | 0 | 58 | 57 |
| | 22 | 20 | 54 | 44.82 | 18 | 11 | 50.8 | 8.954 830 | 0.98 | 8.24 | 0 | 54 | 43 |
| | 23 | 20 | 54 | 27.42 | 18 | 13 | 08.0 | 8.951 584 | 0.98 | 8.25 | 0 | 50 | 30 |
| | 24 | 20 | 54 | 09.92 | 18 | 14 | 25.3 | 8.948 629 | 0.98 | 8.25 | 0 | 46 | 17 |
| | 25 | 20 | 53 | 52.33 | -18 | 15 | 42.9 | 8.945 967 | 0.98 | 8.25 | 0 | 42 | 03 |
| | 26 | 20 | 53 | 34.65 | 18 | 17 | 00.6 | 8.943 598 | 0.98 | 8.25 | 0 | 37 | 50 |
| | 27 | 20 | 53 | 16.90 | 18 | 18 | 18.4 | 8.941 524 | 0.98 | 8.26 | 0 | 33 | 36 |
| | 28 | 20 | 52 | 59.07 | 18 | 19 | 36.3 | 8.939 745 | 0.98 | 8.26 | 0 | 29 | 23 |
| | 29 | 20 | 52 | 41.19 | 18 | 20 | 54.1 | 8.938 262 | 0.98 | 8.26 | 0 | 25 | 09 |
| | 30 | 20 | 52 | 23.26 | 18 | 22 | 11.9 | 8.937 077 | 0.98 | 8.26 | 0 | 20 | 55 |
| | 31 | 20 | 52 | 05.29 | -18 | 23 | 29.7 | 8.936 190 | 0.98 | 8.26 | 0 | 16 | 42 |
| Aug. | 1 | 20 | 51 | 47.29 | 18 | 24 | 47.3 | 8.935 601 | 0.98 | 8.26 | 0 | 12 | 28 |
| | 2 | 20 | 51 | 29.27 | 18 | 26 | 04.8 | 8.935 312 | 0.98 | 8.26 | 0 | 08 | 14 |
| | 3 | 20 | 51 | 11.25 | 18 | 27 | 22.1 | 8.935 322 | 0.98 | 8.26 | 0 | 04 | 00 |
| | 4 | 20 | 50 | 53.22 | 18 | 28 | 39.2 | 8.935 633 | 0.98 | 8.26 | 23 | 55 | 32 |
| | 5 | 20 | 50 | 35.21 | 18 | 29 | 56.0 | 8.936 243 | 0.98 | 8.26 | 23 | 51 | 19 |
| | 6 | 20 | 50 | 17.21 | -18 | 31 | 12.6 | 8.937 155 | 0.98 | 8.26 | 23 | 47 | 05 |
| | 7 | 20 | 49 | 59.24 | 18 | 32 | 28.9 | 8.938 366 | 0.98 | 8.26 | 23 | 42 | 51 |
| | 8 | 20 | 49 | 41.30 | 18 | 33 | 44.8 | 8.939 877 | 0.98 | 8.26 | 23 | 38 | 37 |
| | 9 | 20 | 49 | 23.41 | 18 | 35 | 00.4 | 8.941 688 | 0.98 | 8.26 | 23 | 34 | 24 |
| | 10 | 20 | 49 | 05.57 | 18 | 36 | 15.5 | 8.943 799 | 0.98 | 8.25 | 23 | 30 | 10 |
| | 11 | 20 | 48 | 47.79 | 18 | 37 | 30.1 | 8.946 207 | 0.98 | 8.25 | 23 | 25 | 57 |
| | 12 | 20 | 48 | 30.09 | -18 | 38 | 44.2 | 8.948 913 | 0.98 | 8.25 | 23 | 21 | 43 |
| | 13 | 20 | 48 | 12.47 | 18 | 39 | 57.8 | 8.951 914 | 0.98 | 8.25 | 23 | 17 | 30 |
| | 14 | 20 | 47 | 54.95 | 18 | 41 | 10.8 | 8.955 211 | 0.98 | 8.24 | 23 | 13 | 17 |
| | 15 | 20 | 47 | 37.53 | 18 | 42 | 23.1 | 8.958 800 | 0.98 | 8.24 | 23 | 09 | 04 |
| | 16 | 20 | 47 | 20.24 | -18 | 43 | 34.7 | 8.962 682 | 0.98 | 8.24 | 23 | 04 | 51 |

**SATURN, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Aug. | 16 | 20 | 47 | 20.24 | -18 | 43 | 34.7 | 8.962 682 | 0.98 | 8.24 | 23 | 04 | 51 |
| | 17 | 20 | 47 | 03.06 | 18 | 44 | 45.6 | 8.966 853 | 0.98 | 8.23 | 23 | 00 | 38 |
| | 18 | 20 | 46 | 46.03 | 18 | 45 | 55.8 | 8.971 312 | 0.98 | 8.23 | 22 | 56 | 25 |
| | 19 | 20 | 46 | 29.13 | 18 | 47 | 05.3 | 8.976 057 | 0.98 | 8.22 | 22 | 52 | 12 |
| | 20 | 20 | 46 | 12.38 | 18 | 48 | 14.0 | 8.981 087 | 0.98 | 8.22 | 22 | 47 | 60 |
| | 21 | 20 | 45 | 55.79 | 18 | 49 | 22.0 | 8.986 399 | 0.98 | 8.21 | 22 | 43 | 48 |
| | 22 | 20 | 45 | 39.35 | -18 | 50 | 29.1 | 8.991 991 | 0.98 | 8.21 | 22 | 39 | 36 |
| | 23 | 20 | 45 | 23.08 | 18 | 51 | 35.3 | 8.997 863 | 0.98 | 8.20 | 22 | 35 | 24 |
| | 24 | 20 | 45 | 06.99 | 18 | 52 | 40.7 | 9.004 011 | 0.98 | 8.20 | 22 | 31 | 12 |
| | 25 | 20 | 44 | 51.08 | 18 | 53 | 45.2 | 9.010 434 | 0.98 | 8.19 | 22 | 27 | 00 |
| | 26 | 20 | 44 | 35.36 | 18 | 54 | 48.7 | 9.017 131 | 0.98 | 8.19 | 22 | 22 | 49 |
| | 27 | 20 | 44 | 19.85 | 18 | 55 | 51.2 | 9.024 099 | 0.97 | 8.18 | 22 | 18 | 38 |
| | 28 | 20 | 44 | 04.56 | -18 | 56 | 52.7 | 9.031 336 | 0.97 | 8.17 | 22 | 14 | 27 |
| | 29 | 20 | 43 | 49.48 | 18 | 57 | 53.2 | 9.038 839 | 0.97 | 8.17 | 22 | 10 | 16 |
| | 30 | 20 | 43 | 34.63 | 18 | 58 | 52.6 | 9.046 608 | 0.97 | 8.16 | 22 | 06 | 06 |
| | 31 | 20 | 43 | 20.02 | 18 | 59 | 50.9 | 9.054 639 | 0.97 | 8.15 | 22 | 01 | 56 |
| Sept. | 1 | 20 | 43 | 05.65 | 19 | 00 | 48.1 | 9.062 931 | 0.97 | 8.15 | 21 | 57 | 46 |
| | 2 | 20 | 42 | 51.54 | 19 | 01 | 44.3 | 9.071 479 | 0.97 | 8.14 | 21 | 53 | 36 |
| | 3 | 20 | 42 | 37.68 | -19 | 02 | 39.3 | 9.080 282 | 0.97 | 8.13 | 21 | 49 | 27 |
| | 4 | 20 | 42 | 24.08 | 19 | 03 | 33.2 | 9.089 337 | 0.97 | 8.12 | 21 | 45 | 17 |
| | 5 | 20 | 42 | 10.76 | 19 | 04 | 25.9 | 9.098 641 | 0.97 | 8.11 | 21 | 41 | 08 |
| | 6 | 20 | 41 | 57.71 | 19 | 05 | 17.4 | 9.108 190 | 0.97 | 8.10 | 21 | 36 | 60 |
| | 7 | 20 | 41 | 44.94 | 19 | 06 | 07.6 | 9.117 982 | 0.96 | 8.10 | 21 | 32 | 51 |
| | 8 | 20 | 41 | 32.47 | 19 | 06 | 56.7 | 9.128 013 | 0.96 | 8.09 | 21 | 28 | 43 |
| | 9 | 20 | 41 | 20.29 | -19 | 07 | 44.4 | 9.138 280 | 0.96 | 8.08 | 21 | 24 | 36 |
| | 10 | 20 | 41 | 08.42 | 19 | 08 | 30.8 | 9.148 777 | 0.96 | 8.07 | 21 | 20 | 28 |
| | 11 | 20 | 40 | 56.87 | 19 | 09 | 15.9 | 9.159 503 | 0.96 | 8.06 | 21 | 16 | 21 |
| | 12 | 20 | 40 | 45.65 | 19 | 09 | 59.6 | 9.170 452 | 0.96 | 8.05 | 21 | 12 | 14 |
| | 13 | 20 | 40 | 34.75 | 19 | 10 | 42.0 | 9.181 620 | 0.96 | 8.04 | 21 | 08 | 08 |
| | 14 | 20 | 40 | 24.19 | 19 | 11 | 23.0 | 9.193 004 | 0.96 | 8.03 | 21 | 04 | 02 |
| | 15 | 20 | 40 | 13.96 | -19 | 12 | 02.6 | 9.204 599 | 0.96 | 8.02 | 20 | 59 | 56 |
| | 16 | 20 | 40 | 04.07 | 19 | 12 | 40.9 | 9.216 402 | 0.95 | 8.01 | 20 | 55 | 51 |
| | 17 | 20 | 39 | 54.53 | 19 | 13 | 17.8 | 9.228 407 | 0.95 | 8.00 | 20 | 51 | 45 |
| | 18 | 20 | 39 | 45.33 | 19 | 13 | 53.3 | 9.240 612 | 0.95 | 7.99 | 20 | 47 | 41 |
| | 19 | 20 | 39 | 36.48 | 19 | 14 | 27.4 | 9.253 012 | 0.95 | 7.98 | 20 | 43 | 36 |
| | 20 | 20 | 39 | 27.98 | 19 | 15 | 00.1 | 9.265 603 | 0.95 | 7.97 | 20 | 39 | 32 |
| | 21 | 20 | 39 | 19.84 | -19 | 15 | 31.3 | 9.278 382 | 0.95 | 7.96 | 20 | 35 | 29 |
| | 22 | 20 | 39 | 12.06 | 19 | 16 | 01.1 | 9.291 344 | 0.95 | 7.95 | 20 | 31 | 25 |
| | 23 | 20 | 39 | 04.65 | 19 | 16 | 29.4 | 9.304 485 | 0.95 | 7.93 | 20 | 27 | 22 |
| | 24 | 20 | 38 | 57.61 | 19 | 16 | 56.2 | 9.317 803 | 0.94 | 7.92 | 20 | 23 | 20 |
| | 25 | 20 | 38 | 50.95 | 19 | 17 | 21.5 | 9.331 292 | 0.94 | 7.91 | 20 | 19 | 18 |
| | 26 | 20 | 38 | 44.67 | 19 | 17 | 45.4 | 9.344 949 | 0.94 | 7.90 | 20 | 15 | 16 |
| | 27 | 20 | 38 | 38.78 | -19 | 18 | 07.7 | 9.358 769 | 0.94 | 7.89 | 20 | 11 | 14 |
| | 28 | 20 | 38 | 33.28 | 19 | 18 | 28.6 | 9.372 749 | 0.94 | 7.88 | 20 | 07 | 13 |
| | 29 | 20 | 38 | 28.16 | 19 | 18 | 47.9 | 9.386 885 | 0.94 | 7.86 | 20 | 03 | 12 |
| | 30 | 20 | 38 | 23.44 | 19 | 19 | 05.7 | 9.401 171 | 0.94 | 7.85 | 19 | 59 | 12 |
| Oct. | 1 | 20 | 38 | 19.11 | -19 | 19 | 22.1 | 9.415 603 | 0.93 | 7.84 | 19 | 55 | 12 |

**SATURN, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Oct. | 1 | 20 | 38 | 19.11 | -19 | 19 | 22.1 | 9.415 603 | 0.93 | 7.84 | 19 | 55 | 12 |
| | 2 | 20 | 38 | 15.17 | 19 | 19 | 36.9 | 9.430 178 | 0.93 | 7.83 | 19 | 51 | 13 |
| | 3 | 20 | 38 | 11.63 | 19 | 19 | 50.2 | 9.444 890 | 0.93 | 7.82 | 19 | 47 | 14 |
| | 4 | 20 | 38 | 08.50 | 19 | 20 | 02.0 | 9.459 735 | 0.93 | 7.80 | 19 | 43 | 15 |
| | 5 | 20 | 38 | 05.76 | 19 | 20 | 12.3 | 9.474 708 | 0.93 | 7.79 | 19 | 39 | 17 |
| | 6 | 20 | 38 | 03.43 | 19 | 20 | 20.9 | 9.489 805 | 0.93 | 7.78 | 19 | 35 | 19 |
| | 7 | 20 | 38 | 01.51 | -19 | 20 | 28.0 | 9.505 019 | 0.93 | 7.77 | 19 | 31 | 21 |
| | 8 | 20 | 38 | 00.01 | 19 | 20 | 33.6 | 9.520 347 | 0.92 | 7.75 | 19 | 27 | 24 |
| | 9 | 20 | 37 | 58.92 | 19 | 20 | 37.5 | 9.535 783 | 0.92 | 7.74 | 19 | 23 | 28 |
| | 10 | 20 | 37 | 58.25 | 19 | 20 | 39.8 | 9.551 321 | 0.92 | 7.73 | 19 | 19 | 31 |
| | 11 | 20 | 37 | 58.00 | 19 | 20 | 40.6 | 9.566 956 | 0.92 | 7.72 | 19 | 15 | 36 |
| | 12 | 20 | 37 | 58.16 | 19 | 20 | 39.8 | 9.582 684 | 0.92 | 7.70 | 19 | 11 | 40 |
| | 13 | 20 | 37 | 58.74 | -19 | 20 | 37.5 | 9.598 499 | 0.92 | 7.69 | 19 | 07 | 45 |
| | 14 | 20 | 37 | 59.74 | 19 | 20 | 33.6 | 9.614 396 | 0.91 | 7.68 | 19 | 03 | 51 |
| | 15 | 20 | 38 | 01.14 | 19 | 20 | 28.2 | 9.630 371 | 0.91 | 7.67 | 18 | 59 | 56 |
| | 16 | 20 | 38 | 02.95 | 19 | 20 | 21.3 | 9.646 419 | 0.91 | 7.65 | 18 | 56 | 03 |
| | 17 | 20 | 38 | 05.18 | 19 | 20 | 12.8 | 9.662 534 | 0.91 | 7.64 | 18 | 52 | 09 |
| | 18 | 20 | 38 | 07.81 | 19 | 20 | 02.7 | 9.678 712 | 0.91 | 7.63 | 18 | 48 | 16 |
| | 19 | 20 | 38 | 10.86 | -19 | 19 | 51.1 | 9.694 950 | 0.91 | 7.61 | 18 | 44 | 24 |
| | 20 | 20 | 38 | 14.31 | 19 | 19 | 37.9 | 9.711 241 | 0.91 | 7.60 | 18 | 40 | 32 |
| | 21 | 20 | 38 | 18.18 | 19 | 19 | 23.2 | 9.727 582 | 0.90 | 7.59 | 18 | 36 | 40 |
| | 22 | 20 | 38 | 22.46 | 19 | 19 | 06.9 | 9.743 968 | 0.90 | 7.58 | 18 | 32 | 48 |
| | 23 | 20 | 38 | 27.16 | 19 | 18 | 49.0 | 9.760 395 | 0.90 | 7.56 | 18 | 28 | 58 |
| | 24 | 20 | 38 | 32.26 | 19 | 18 | 29.6 | 9.776 858 | 0.90 | 7.55 | 18 | 25 | 07 |
| | 25 | 20 | 38 | 37.78 | -19 | 18 | 08.7 | 9.793 353 | 0.90 | 7.54 | 18 | 21 | 17 |
| | 26 | 20 | 38 | 43.70 | 19 | 17 | 46.2 | 9.809 874 | 0.90 | 7.53 | 18 | 17 | 27 |
| | 27 | 20 | 38 | 50.03 | 19 | 17 | 22.2 | 9.826 418 | 0.89 | 7.51 | 18 | 13 | 38 |
| | 28 | 20 | 38 | 56.77 | 19 | 16 | 56.7 | 9.842 980 | 0.89 | 7.50 | 18 | 09 | 49 |
| | 29 | 20 | 39 | 03.91 | 19 | 16 | 29.7 | 9.859 555 | 0.89 | 7.49 | 18 | 06 | 00 |
| | 30 | 20 | 39 | 11.44 | 19 | 16 | 01.2 | 9.876 138 | 0.89 | 7.47 | 18 | 02 | 12 |
| | 31 | 20 | 39 | 19.38 | -19 | 15 | 31.2 | 9.892 724 | 0.89 | 7.46 | 17 | 58 | 25 |
| Nov. | 1 | 20 | 39 | 27.71 | 19 | 14 | 59.7 | 9.909 310 | 0.89 | 7.45 | 17 | 54 | 37 |
| | 2 | 20 | 39 | 36.44 | 19 | 14 | 26.7 | 9.925 889 | 0.89 | 7.44 | 17 | 50 | 50 |
| | 3 | 20 | 39 | 45.57 | 19 | 13 | 52.1 | 9.942 458 | 0.88 | 7.42 | 17 | 47 | 04 |
| | 4 | 20 | 39 | 55.09 | 19 | 13 | 16.0 | 9.959 010 | 0.88 | 7.41 | 17 | 43 | 18 |
| | 5 | 20 | 40 | 05.00 | 19 | 12 | 38.4 | 9.975 541 | 0.88 | 7.40 | 17 | 39 | 32 |
| | 6 | 20 | 40 | 15.32 | -19 | 11 | 59.3 | 9.992 046 | 0.88 | 7.39 | 17 | 35 | 47 |
| | 7 | 20 | 40 | 26.02 | 19 | 11 | 18.7 | 10.008 519 | 0.88 | 7.38 | 17 | 32 | 02 |
| | 8 | 20 | 40 | 37.12 | 19 | 10 | 36.6 | 10.024 956 | 0.88 | 7.36 | 17 | 28 | 17 |
| | 9 | 20 | 40 | 48.59 | 19 | 09 | 53.1 | 10.041 351 | 0.88 | 7.35 | 17 | 24 | 33 |
| | 10 | 20 | 41 | 00.44 | 19 | 09 | 08.1 | 10.057 701 | 0.87 | 7.34 | 17 | 20 | 49 |
| | 11 | 20 | 41 | 12.67 | 19 | 08 | 21.7 | 10.073 999 | 0.87 | 7.33 | 17 | 17 | 05 |
| | 12 | 20 | 41 | 25.26 | -19 | 07 | 33.9 | 10.090 243 | 0.87 | 7.32 | 17 | 13 | 22 |
| | 13 | 20 | 41 | 38.21 | 19 | 06 | 44.6 | 10.106 427 | 0.87 | 7.30 | 17 | 09 | 40 |
| | 14 | 20 | 41 | 51.53 | 19 | 05 | 53.9 | 10.122 547 | 0.87 | 7.29 | 17 | 05 | 57 |
| | 15 | 20 | 42 | 05.20 | 19 | 05 | 01.8 | 10.138 599 | 0.87 | 7.28 | 17 | 02 | 15 |
| | 16 | 20 | 42 | 19.24 | -19 | 04 | 08.3 | 10.154 580 | 0.87 | 7.27 | 16 | 58 | 33 |

**SATURN, 2021**
RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Nov. | 16 | 20 | 42 | 19.24 | -19 | 04 | 08.3 | 10.154 580 | 0.87 | 7.27 | 16 | 58 | 33 |
| | 17 | 20 | 42 | 33.62 | 19 | 03 | 13.3 | 10.170 484 | 0.86 | 7.26 | 16 | 54 | 52 |
| | 18 | 20 | 42 | 48.36 | 19 | 02 | 17.0 | 10.186 308 | 0.86 | 7.25 | 16 | 51 | 11 |
| | 19 | 20 | 43 | 03.45 | 19 | 01 | 19.3 | 10.202 049 | 0.86 | 7.24 | 16 | 47 | 30 |
| | 20 | 20 | 43 | 18.88 | 19 | 00 | 20.1 | 10.217 701 | 0.86 | 7.22 | 16 | 43 | 50 |
| | 21 | 20 | 43 | 34.66 | 18 | 59 | 19.7 | 10.233 262 | 0.86 | 7.21 | 16 | 40 | 10 |
| | 22 | 20 | 43 | 50.77 | -18 | 58 | 17.8 | 10.248 726 | 0.86 | 7.20 | 16 | 36 | 30 |
| | 23 | 20 | 44 | 07.22 | 18 | 57 | 14.7 | 10.264 092 | 0.86 | 7.19 | 16 | 32 | 51 |
| | 24 | 20 | 44 | 24.00 | 18 | 56 | 10.2 | 10.279 354 | 0.86 | 7.18 | 16 | 29 | 12 |
| | 25 | 20 | 44 | 41.11 | 18 | 55 | 04.4 | 10.294 508 | 0.85 | 7.17 | 16 | 25 | 33 |
| | 26 | 20 | 44 | 58.53 | 18 | 53 | 57.3 | 10.309 551 | 0.85 | 7.16 | 16 | 21 | 55 |
| | 27 | 20 | 45 | 16.27 | 18 | 52 | 48.9 | 10.324 479 | 0.85 | 7.15 | 16 | 18 | 17 |
| | 28 | 20 | 45 | 34.32 | -18 | 51 | 39.2 | 10.339 287 | 0.85 | 7.14 | 16 | 14 | 39 |
| | 29 | 20 | 45 | 52.69 | 18 | 50 | 28.2 | 10.353 973 | 0.85 | 7.13 | 16 | 11 | 02 |
| | 30 | 20 | 46 | 11.36 | 18 | 49 | 16.0 | 10.368 531 | 0.85 | 7.12 | 16 | 07 | 25 |
| Dec. | 1 | 20 | 46 | 30.33 | 18 | 48 | 02.4 | 10.382 958 | 0.85 | 7.11 | 16 | 03 | 48 |
| | 2 | 20 | 46 | 49.61 | 18 | 46 | 47.5 | 10.397 249 | 0.85 | 7.10 | 16 | 00 | 11 |
| | 3 | 20 | 47 | 09.19 | 18 | 45 | 31.4 | 10.411 401 | 0.84 | 7.09 | 15 | 56 | 35 |
| | 4 | 20 | 47 | 29.07 | -18 | 44 | 14.0 | 10.425 409 | 0.84 | 7.08 | 15 | 52 | 59 |
| | 5 | 20 | 47 | 49.24 | 18 | 42 | 55.3 | 10.439 270 | 0.84 | 7.07 | 15 | 49 | 23 |
| | 6 | 20 | 48 | 09.69 | 18 | 41 | 35.5 | 10.452 979 | 0.84 | 7.06 | 15 | 45 | 48 |
| | 7 | 20 | 48 | 30.43 | 18 | 40 | 14.5 | 10.466 532 | 0.84 | 7.05 | 15 | 42 | 13 |
| | 8 | 20 | 48 | 51.43 | 18 | 38 | 52.3 | 10.479 926 | 0.84 | 7.04 | 15 | 38 | 38 |
| | 9 | 20 | 49 | 12.70 | 18 | 37 | 28.9 | 10.493 158 | 0.84 | 7.04 | 15 | 35 | 04 |
| | 10 | 20 | 49 | 34.22 | -18 | 36 | 04.5 | 10.506 224 | 0.84 | 7.03 | 15 | 31 | 29 |
| | 11 | 20 | 49 | 56.00 | 18 | 34 | 38.8 | 10.519 122 | 0.84 | 7.02 | 15 | 27 | 55 |
| | 12 | 20 | 50 | 18.04 | 18 | 33 | 12.0 | 10.531 847 | 0.84 | 7.01 | 15 | 24 | 21 |
| | 13 | 20 | 50 | 40.32 | 18 | 31 | 44.1 | 10.544 398 | 0.83 | 7.00 | 15 | 20 | 48 |
| | 14 | 20 | 51 | 02.84 | 18 | 30 | 15.1 | 10.556 771 | 0.83 | 6.99 | 15 | 17 | 14 |
| | 15 | 20 | 51 | 25.61 | 18 | 28 | 44.9 | 10.568 963 | 0.83 | 6.98 | 15 | 13 | 41 |
| | 16 | 20 | 51 | 48.62 | -18 | 27 | 13.7 | 10.580 973 | 0.83 | 6.98 | 15 | 10 | 08 |
| | 17 | 20 | 52 | 11.85 | 18 | 25 | 41.3 | 10.592 797 | 0.83 | 6.97 | 15 | 06 | 36 |
| | 18 | 20 | 52 | 35.32 | 18 | 24 | 08.0 | 10.604 432 | 0.83 | 6.96 | 15 | 03 | 03 |
| | 19 | 20 | 52 | 59.01 | 18 | 22 | 33.5 | 10.615 876 | 0.83 | 6.95 | 14 | 59 | 31 |
| | 20 | 20 | 53 | 22.91 | 18 | 20 | 58.1 | 10.627 127 | 0.83 | 6.95 | 14 | 55 | 59 |
| | 21 | 20 | 53 | 47.03 | 18 | 19 | 21.7 | 10.638 181 | 0.83 | 6.94 | 14 | 52 | 27 |
| | 22 | 20 | 54 | 11.36 | -18 | 17 | 44.2 | 10.649 037 | 0.83 | 6.93 | 14 | 48 | 56 |
| | 23 | 20 | 54 | 35.89 | 18 | 16 | 05.9 | 10.659 691 | 0.82 | 6.93 | 14 | 45 | 24 |
| | 24 | 20 | 55 | 00.61 | 18 | 14 | 26.5 | 10.670 142 | 0.82 | 6.92 | 14 | 41 | 53 |
| | 25 | 20 | 55 | 25.53 | 18 | 12 | 46.2 | 10.680 386 | 0.82 | 6.91 | 14 | 38 | 22 |
| | 26 | 20 | 55 | 50.64 | 18 | 11 | 05.0 | 10.690 421 | 0.82 | 6.91 | 14 | 34 | 51 |
| | 27 | 20 | 56 | 15.93 | 18 | 09 | 22.8 | 10.700 245 | 0.82 | 6.90 | 14 | 31 | 21 |
| | 28 | 20 | 56 | 41.40 | -18 | 07 | 39.7 | 10.709 855 | 0.82 | 6.89 | 14 | 27 | 50 |
| | 29 | 20 | 57 | 07.05 | 18 | 05 | 55.7 | 10.719 248 | 0.82 | 6.89 | 14 | 24 | 20 |
| | 30 | 20 | 57 | 32.88 | 18 | 04 | 10.7 | 10.728 421 | 0.82 | 6.88 | 14 | 20 | 50 |
| | 31 | 20 | 57 | 58.88 | 18 | 02 | 24.9 | 10.737 373 | 0.82 | 6.88 | 14 | 17 | 20 |
| | 32 | 20 | 58 | 25.05 | -18 | 00 | 38.1 | 10.746 100 | 0.82 | 6.87 | 14 | 13 | 50 |

**URANUS, 2021**

HELIOCENTRIC POSITIONS FOR $0^h$ TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

| Date | Heliocentric Longitude | Heliocentric Latitude | Radius Vector | Date | Heliocentric Longitude | Heliocentric Latitude | Radius Vector |
|---|---|---|---|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | | | ° ′ ″ | ° ′ ″ | |
| Jan. 1 | 39 21 50.9 | -0 26 24.8 | 19.772 16 | Apr. 3 | 40 23 02.3 | -0 25 44.0 | 19.760 00 |
| 3 | 39 23 10.6 | 0 26 23.9 | 19.771 90 | 5 | 40 24 22.2 | 0 25 43.2 | 19.759 73 |
| 5 | 39 24 30.4 | 0 26 23.0 | 19.771 63 | 7 | 40 25 42.1 | 0 25 42.3 | 19.759 47 |
| 7 | 39 25 50.2 | 0 26 22.1 | 19.771 37 | 9 | 40 27 01.9 | 0 25 41.4 | 19.759 20 |
| 9 | 39 27 09.9 | 0 26 21.3 | 19.771 11 | 11 | 40 28 21.8 | 0 25 40.5 | 19.758 93 |
| 11 | 39 28 29.7 | 0 26 20.4 | 19.770 85 | 13 | 40 29 41.7 | 0 25 39.6 | 19.758 67 |
| 13 | 39 29 49.5 | -0 26 19.5 | 19.770 58 | 15 | 40 31 01.6 | -0 25 38.7 | 19.758 40 |
| 15 | 39 31 09.2 | 0 26 18.6 | 19.770 32 | 17 | 40 32 21.5 | 0 25 37.8 | 19.758 13 |
| 17 | 39 32 29.0 | 0 26 17.8 | 19.770 06 | 19 | 40 33 41.4 | 0 25 36.9 | 19.757 87 |
| 19 | 39 33 48.8 | 0 26 16.9 | 19.769 79 | 21 | 40 35 01.3 | 0 25 36.0 | 19.757 60 |
| 21 | 39 35 08.5 | 0 26 16.0 | 19.769 53 | 23 | 40 36 21.2 | 0 25 35.1 | 19.757 33 |
| 23 | 39 36 28.3 | 0 26 15.1 | 19.769 27 | 25 | 40 37 41.1 | 0 25 34.2 | 19.757 06 |
| 25 | 39 37 48.1 | -0 26 14.2 | 19.769 01 | 27 | 40 39 01.0 | -0 25 33.3 | 19.756 80 |
| 27 | 39 39 07.9 | 0 26 13.3 | 19.768 74 | 29 | 40 40 20.9 | 0 25 32.4 | 19.756 53 |
| 29 | 39 40 27.7 | 0 26 12.4 | 19.768 48 | May 1 | 40 41 40.8 | 0 25 31.6 | 19.756 26 |
| 31 | 39 41 47.5 | 0 26 11.6 | 19.768 21 | 3 | 40 43 00.7 | 0 25 30.6 | 19.755 99 |
| Feb. 2 | 39 43 07.3 | 0 26 10.7 | 19.767 95 | 5 | 40 44 20.6 | 0 25 29.7 | 19.755 73 |
| 4 | 39 44 27.1 | 0 26 09.8 | 19.767 69 | 7 | 40 45 40.5 | 0 25 28.8 | 19.755 46 |
| 6 | 39 45 46.9 | -0 26 08.9 | 19.767 42 | 9 | 40 47 00.5 | -0 25 28.0 | 19.755 19 |
| 8 | 39 47 06.7 | 0 26 08.0 | 19.767 16 | 11 | 40 48 20.4 | 0 25 27.1 | 19.754 92 |
| 10 | 39 48 26.5 | 0 26 07.2 | 19.766 90 | 13 | 40 49 40.3 | 0 25 26.2 | 19.754 65 |
| 12 | 39 49 46.3 | 0 26 06.3 | 19.766 63 | 15 | 40 51 00.2 | 0 25 25.3 | 19.754 38 |
| 14 | 39 51 06.1 | 0 26 05.4 | 19.766 37 | 17 | 40 52 20.2 | 0 25 24.4 | 19.754 12 |
| 16 | 39 52 25.9 | 0 26 04.5 | 19.766 10 | 19 | 40 53 40.1 | 0 25 23.5 | 19.753 85 |
| 18 | 39 53 45.7 | -0 26 03.6 | 19.765 84 | 21 | 40 55 00.0 | -0 25 22.6 | 19.753 58 |
| 20 | 39 55 05.5 | 0 26 02.7 | 19.765 58 | 23 | 40 56 20.0 | 0 25 21.7 | 19.753 31 |
| 22 | 39 56 25.4 | 0 26 01.8 | 19.765 31 | 25 | 40 57 39.9 | 0 25 20.8 | 19.753 04 |
| 24 | 39 57 45.2 | 0 26 00.9 | 19.765 05 | 27 | 40 58 59.9 | 0 25 19.9 | 19.752 77 |
| 26 | 39 59 05.0 | 0 26 00.1 | 19.764 78 | 29 | 41 00 19.8 | 0 25 19.0 | 19.752 50 |
| 28 | 40 00 24.8 | 0 25 59.2 | 19.764 52 | 31 | 41 01 39.8 | 0 25 18.1 | 19.752 23 |
| Mar. 2 | 40 01 44.7 | -0 25 58.3 | 19.764 25 | June 2 | 41 02 59.7 | -0 25 17.2 | 19.751 96 |
| 4 | 40 03 04.5 | 0 25 57.4 | 19.763 99 | 4 | 41 04 19.7 | 0 25 16.3 | 19.751 69 |
| 6 | 40 04 24.3 | 0 25 56.5 | 19.763 72 | 6 | 41 05 39.6 | 0 25 15.4 | 19.751 42 |
| 8 | 40 05 44.2 | 0 25 55.6 | 19.763 46 | 8 | 41 06 59.6 | 0 25 14.5 | 19.751 16 |
| 10 | 40 07 04.0 | 0 25 54.7 | 19.763 19 | 10 | 41 08 19.5 | 0 25 13.6 | 19.750 89 |
| 12 | 40 08 23.9 | 0 25 53.8 | 19.762 93 | 12 | 41 09 39.5 | 0 25 12.7 | 19.750 62 |
| 14 | 40 09 43.7 | -0 25 52.9 | 19.762 66 | 14 | 41 10 59.5 | -0 25 11.8 | 19.750 35 |
| 16 | 40 11 03.6 | 0 25 52.1 | 19.762 39 | 16 | 41 12 19.4 | 0 25 10.9 | 19.750 08 |
| 18 | 40 12 23.4 | 0 25 51.2 | 19.762 13 | 18 | 41 13 39.4 | 0 25 10.0 | 19.749 81 |
| 20 | 40 13 43.3 | 0 25 50.3 | 19.761 86 | 20 | 41 14 59.4 | 0 25 09.1 | 19.749 54 |
| 22 | 40 15 03.1 | 0 25 49.4 | 19.761 60 | 22 | 41 16 19.3 | 0 25 08.2 | 19.749 27 |
| 24 | 40 16 23.0 | 0 25 48.5 | 19.761 33 | 24 | 41 17 39.3 | 0 25 07.3 | 19.748 99 |
| 26 | 40 17 42.8 | -0 25 47.6 | 19.761 07 | 26 | 41 18 59.3 | -0 25 06.4 | 19.748 72 |
| 28 | 40 19 02.7 | 0 25 46.7 | 19.760 80 | 28 | 41 20 19.3 | 0 25 05.5 | 19.748 45 |
| 30 | 40 20 22.6 | 0 25 45.8 | 19.760 53 | 30 | 41 21 39.3 | 0 25 04.6 | 19.748 18 |
| Apr. 1 | 40 21 42.5 | 0 25 44.9 | 19.760 27 | July 2 | 41 22 59.3 | 0 25 03.7 | 19.747 91 |
| 3 | 40 23 02.3 | -0 25 44.0 | 19.760 00 | 4 | 41 24 19.3 | -0 25 02.8 | 19.747 64 |

**URANUS, 2021**

HELIOCENTRIC POSITIONS FOR $0^h$ TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

| Date | Heliocentric Longitude | Heliocentric Latitude | Radius Vector | Date | Heliocentric Longitude | Heliocentric Latitude | Radius Vector |
|---|---|---|---|---|---|---|---|
| | ° ′ ″ | ° ′ ″ | | | ° ′ ″ | ° ′ ″ | |
| July 2 | 41 22 59.3 | -0 25 03.7 | 19.747 91 | Oct. 2 | 42 24 21.7 | -0 24 21.8 | 19.735 36 |
| 4 | 41 24 19.3 | 0 25 02.8 | 19.747 64 | 4 | 42 25 41.9 | 0 24 20.9 | 19.735 08 |
| 6 | 41 25 39.3 | 0 25 01.8 | 19.747 37 | 6 | 42 27 02.0 | 0 24 20.0 | 19.734 81 |
| 8 | 41 26 59.3 | 0 25 00.9 | 19.747 10 | 8 | 42 28 22.1 | 0 24 19.1 | 19.734 53 |
| 10 | 41 28 19.3 | 0 25 00.0 | 19.746 83 | 10 | 42 29 42.2 | 0 24 18.2 | 19.734 26 |
| 12 | 41 29 39.3 | 0 24 59.1 | 19.746 56 | 12 | 42 31 02.4 | 0 24 17.3 | 19.733 98 |
| 14 | 41 30 59.3 | -0 24 58.2 | 19.746 29 | 14 | 42 32 22.5 | -0 24 16.3 | 19.733 70 |
| 16 | 41 32 19.3 | 0 24 57.3 | 19.746 01 | 16 | 42 33 42.6 | 0 24 15.4 | 19.733 43 |
| 18 | 41 33 39.3 | 0 24 56.4 | 19.745 74 | 18 | 42 35 02.8 | 0 24 14.5 | 19.733 15 |
| 20 | 41 34 59.3 | 0 24 55.5 | 19.745 47 | 20 | 42 36 22.9 | 0 24 13.6 | 19.732 88 |
| 22 | 41 36 19.3 | 0 24 54.6 | 19.745 20 | 22 | 42 37 43.1 | 0 24 12.7 | 19.732 60 |
| 24 | 41 37 39.3 | 0 24 53.7 | 19.744 93 | 24 | 42 39 03.2 | 0 24 11.8 | 19.732 32 |
| 26 | 41 38 59.4 | -0 24 52.8 | 19.744 66 | 26 | 42 40 23.3 | -0 24 10.8 | 19.732 05 |
| 28 | 41 40 19.4 | 0 24 51.9 | 19.744 38 | 28 | 42 41 43.5 | 0 24 09.9 | 19.731 77 |
| 30 | 41 41 39.4 | 0 24 51.0 | 19.744 11 | 30 | 42 43 03.7 | 0 24 09.0 | 19.731 49 |
| Aug. 1 | 41 42 59.5 | 0 24 50.1 | 19.743 84 | Nov. 1 | 42 44 23.8 | 0 24 08.1 | 19.731 22 |
| 3 | 41 44 19.5 | 0 24 49.2 | 19.743 57 | 3 | 42 45 44.0 | 0 24 07.2 | 19.730 94 |
| 5 | 41 45 39.5 | 0 24 48.3 | 19.743 30 | 5 | 42 47 04.1 | 0 24 06.2 | 19.730 66 |
| 7 | 41 46 59.6 | -0 24 47.4 | 19.743 02 | 7 | 42 48 24.3 | -0 24 05.3 | 19.730 39 |
| 9 | 41 48 19.6 | 0 24 46.5 | 19.742 75 | 9 | 42 49 44.5 | 0 24 04.4 | 19.730 11 |
| 11 | 41 49 39.7 | 0 24 45.5 | 19.742 48 | 11 | 42 51 04.6 | 0 24 03.5 | 19.729 83 |
| 13 | 41 50 59.7 | 0 24 44.6 | 19.742 21 | 13 | 42 52 24.8 | 0 24 02.6 | 19.729 56 |
| 15 | 41 52 19.8 | 0 24 43.7 | 19.741 93 | 15 | 42 53 45.0 | 0 24 01.6 | 19.729 28 |
| 17 | 41 53 39.8 | 0 24 42.8 | 19.741 66 | 17 | 42 55 05.2 | 0 24 00.7 | 19.729 00 |
| 19 | 41 54 59.9 | -0 24 41.9 | 19.741 39 | 19 | 42 56 25.4 | -0 23 59.8 | 19.728 72 |
| 21 | 41 56 19.9 | 0 24 41.0 | 19.741 11 | 21 | 42 57 45.5 | 0 23 58.9 | 19.728 45 |
| 23 | 41 57 40.0 | 0 24 40.1 | 19.740 84 | 23 | 42 59 05.7 | 0 23 58.0 | 19.728 17 |
| 25 | 41 59 00.0 | 0 24 39.2 | 19.740 57 | 25 | 43 00 25.9 | 0 23 57.0 | 19.727 89 |
| 27 | 42 00 20.1 | 0 24 38.3 | 19.740 29 | 27 | 43 01 46.1 | 0 23 56.1 | 19.727 61 |
| 29 | 42 01 40.2 | 0 24 37.4 | 19.740 02 | 29 | 43 03 06.3 | 0 23 55.2 | 19.727 33 |
| 31 | 42 03 00.2 | -0 24 36.4 | 19.739 75 | Dec. 1 | 43 04 26.5 | -0 23 54.3 | 19.727 05 |
| Sept. 2 | 42 04 20.3 | 0 24 35.5 | 19.739 47 | 3 | 43 05 46.7 | 0 23 53.4 | 19.726 78 |
| 4 | 42 05 40.4 | 0 24 34.6 | 19.739 20 | 5 | 43 07 06.9 | 0 23 52.4 | 19.726 50 |
| 6 | 42 07 00.5 | 0 24 33.7 | 19.738 93 | 7 | 43 08 27.1 | 0 23 51.5 | 19.726 22 |
| 8 | 42 08 20.6 | 0 24 32.8 | 19.738 65 | 9 | 43 09 47.3 | 0 23 50.6 | 19.725 94 |
| 10 | 42 09 40.6 | 0 24 31.9 | 19.738 38 | 11 | 43 11 07.5 | 0 23 49.7 | 19.725 66 |
| 12 | 42 11 00.7 | -0 24 31.0 | 19.738 10 | 13 | 43 12 27.7 | -0 23 48.7 | 19.725 38 |
| 14 | 42 12 20.8 | 0 24 30.1 | 19.737 83 | 15 | 43 13 47.9 | 0 23 47.8 | 19.725 10 |
| 16 | 42 13 40.9 | 0 24 29.1 | 19.737 56 | 17 | 43 15 08.2 | 0 23 46.9 | 19.724 82 |
| 18 | 42 15 01.0 | 0 24 28.2 | 19.737 28 | 19 | 43 16 28.4 | 0 23 46.0 | 19.724 54 |
| 20 | 42 16 21.1 | 0 24 27.3 | 19.737 01 | 21 | 43 17 48.6 | 0 23 45.0 | 19.724 27 |
| 22 | 42 17 41.2 | 0 24 26.4 | 19.736 73 | 23 | 43 19 08.8 | 0 23 44.1 | 19.723 99 |
| 24 | 42 19 01.3 | -0 24 25.5 | 19.736 46 | 25 | 43 20 29.1 | -0 23 43.2 | 19.723 71 |
| 26 | 42 20 21.4 | 0 24 24.6 | 19.736 18 | 27 | 43 21 49.3 | 0 23 42.2 | 19.723 43 |
| 28 | 42 21 41.5 | 0 24 23.7 | 19.735 91 | 29 | 43 23 09.5 | 0 23 41.3 | 19.723 15 |
| 30 | 42 23 01.6 | 0 24 22.8 | 19.735 63 | 31 | 43 24 29.7 | 0 23 40.4 | 19.722 87 |
| Oct. 2 | 42 24 21.7 | -0 24 21.8 | 19.735 36 | 33 | 43 25 50.0 | -0 23 39.5 | 19.722 59 |

**URANUS, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| Jan. | 0 | 36 | 48 | 40.4 | -0 | 27 | 03.7 | Feb. | 15 | 37 | 09 | 11.9 | -0 | 25 | 41.3 |
| | 1 | 36 | 47 | 57.6 | 0 | 27 | 02.0 | | 16 | 37 | 10 | 49.5 | 0 | 25 | 39.7 |
| | 2 | 36 | 47 | 17.8 | 0 | 27 | 00.2 | | 17 | 37 | 12 | 29.9 | 0 | 25 | 38.0 |
| | 3 | 36 | 46 | 40.9 | 0 | 26 | 58.5 | | 18 | 37 | 14 | 13.1 | 0 | 25 | 36.3 |
| | 4 | 36 | 46 | 07.0 | 0 | 26 | 56.7 | | 19 | 37 | 15 | 59.0 | 0 | 25 | 34.7 |
| | 5 | 36 | 45 | 36.1 | 0 | 26 | 54.9 | | 20 | 37 | 17 | 47.7 | 0 | 25 | 33.0 |
| | 6 | 36 | 45 | 08.2 | -0 | 26 | 53.1 | | 21 | 37 | 19 | 39.0 | -0 | 25 | 31.4 |
| | 7 | 36 | 44 | 43.5 | 0 | 26 | 51.3 | | 22 | 37 | 21 | 33.0 | 0 | 25 | 29.7 |
| | 8 | 36 | 44 | 21.8 | 0 | 26 | 49.5 | | 23 | 37 | 23 | 29.5 | 0 | 25 | 28.1 |
| | 9 | 36 | 44 | 03.3 | 0 | 26 | 47.7 | | 24 | 37 | 25 | 28.7 | 0 | 25 | 26.5 |
| | 10 | 36 | 43 | 48.0 | 0 | 26 | 45.9 | | 25 | 37 | 27 | 30.3 | 0 | 25 | 25.0 |
| | 11 | 36 | 43 | 35.9 | 0 | 26 | 44.1 | | 26 | 37 | 29 | 34.4 | 0 | 25 | 23.4 |
| | 12 | 36 | 43 | 27.0 | -0 | 26 | 42.3 | | 27 | 37 | 31 | 40.8 | -0 | 25 | 21.8 |
| | 13 | 36 | 43 | 21.2 | 0 | 26 | 40.5 | | 28 | 37 | 33 | 49.7 | 0 | 25 | 20.3 |
| | 14 | 36 | 43 | 18.5 | 0 | 26 | 38.7 | Mar. | 1 | 37 | 36 | 00.9 | 0 | 25 | 18.8 |
| | 15 | 36 | 43 | 18.9 | 0 | 26 | 36.8 | | 2 | 37 | 38 | 14.5 | 0 | 25 | 17.2 |
| | 16 | 36 | 43 | 22.5 | 0 | 26 | 35.0 | | 3 | 37 | 40 | 30.5 | 0 | 25 | 15.7 |
| | 17 | 36 | 43 | 29.1 | 0 | 26 | 33.2 | | 4 | 37 | 42 | 48.9 | 0 | 25 | 14.3 |
| | 18 | 36 | 43 | 39.0 | -0 | 26 | 31.4 | | 5 | 37 | 45 | 09.6 | -0 | 25 | 12.8 |
| | 19 | 36 | 43 | 51.9 | 0 | 26 | 29.5 | | 6 | 37 | 47 | 32.6 | 0 | 25 | 11.3 |
| | 20 | 36 | 44 | 08.1 | 0 | 26 | 27.7 | | 7 | 37 | 49 | 57.8 | 0 | 25 | 09.9 |
| | 21 | 36 | 44 | 27.4 | 0 | 26 | 25.9 | | 8 | 37 | 52 | 25.3 | 0 | 25 | 08.5 |
| | 22 | 36 | 44 | 49.9 | 0 | 26 | 24.0 | | 9 | 37 | 54 | 54.9 | 0 | 25 | 07.1 |
| | 23 | 36 | 45 | 15.6 | 0 | 26 | 22.2 | | 10 | 37 | 57 | 26.6 | 0 | 25 | 05.7 |
| | 24 | 36 | 45 | 44.5 | -0 | 26 | 20.3 | | 11 | 38 | 00 | 00.4 | -0 | 25 | 04.3 |
| | 25 | 36 | 46 | 16.6 | 0 | 26 | 18.5 | | 12 | 38 | 02 | 36.1 | 0 | 25 | 02.9 |
| | 26 | 36 | 46 | 51.8 | 0 | 26 | 16.7 | | 13 | 38 | 05 | 13.8 | 0 | 25 | 01.6 |
| | 27 | 36 | 47 | 30.1 | 0 | 26 | 14.9 | | 14 | 38 | 07 | 53.5 | 0 | 25 | 00.3 |
| | 28 | 36 | 48 | 11.5 | 0 | 26 | 13.0 | | 15 | 38 | 10 | 35.1 | 0 | 24 | 58.9 |
| | 29 | 36 | 48 | 56.0 | 0 | 26 | 11.2 | | 16 | 38 | 13 | 18.6 | 0 | 24 | 57.6 |
| | 30 | 36 | 49 | 43.5 | -0 | 26 | 09.4 | | 17 | 38 | 16 | 04.0 | -0 | 24 | 56.4 |
| | 31 | 36 | 50 | 34.0 | 0 | 26 | 07.6 | | 18 | 38 | 18 | 51.3 | 0 | 24 | 55.1 |
| Feb. | 1 | 36 | 51 | 27.5 | 0 | 26 | 05.8 | | 19 | 38 | 21 | 40.4 | 0 | 24 | 53.8 |
| | 2 | 36 | 52 | 24.1 | 0 | 26 | 04.0 | | 20 | 38 | 24 | 31.2 | 0 | 24 | 52.6 |
| | 3 | 36 | 53 | 23.7 | 0 | 26 | 02.2 | | 21 | 38 | 27 | 23.8 | 0 | 24 | 51.4 |
| | 4 | 36 | 54 | 26.3 | 0 | 26 | 00.4 | | 22 | 38 | 30 | 18.1 | 0 | 24 | 50.2 |
| | 5 | 36 | 55 | 32.0 | -0 | 25 | 58.7 | | 23 | 38 | 33 | 13.9 | -0 | 24 | 49.0 |
| | 6 | 36 | 56 | 40.8 | 0 | 25 | 56.9 | | 24 | 38 | 36 | 11.3 | 0 | 24 | 47.8 |
| | 7 | 36 | 57 | 52.6 | 0 | 25 | 55.1 | | 25 | 38 | 39 | 10.3 | 0 | 24 | 46.7 |
| | 8 | 36 | 59 | 07.4 | 0 | 25 | 53.4 | | 26 | 38 | 42 | 10.6 | 0 | 24 | 45.5 |
| | 9 | 37 | 00 | 25.2 | 0 | 25 | 51.6 | | 27 | 38 | 45 | 12.4 | 0 | 24 | 44.4 |
| | 10 | 37 | 01 | 45.9 | 0 | 25 | 49.9 | | 28 | 38 | 48 | 15.5 | 0 | 24 | 43.3 |
| | 11 | 37 | 03 | 09.4 | -0 | 25 | 48.2 | | 29 | 38 | 51 | 20.0 | -0 | 24 | 42.2 |
| | 12 | 37 | 04 | 35.8 | 0 | 25 | 46.5 | | 30 | 38 | 54 | 25.9 | 0 | 24 | 41.2 |
| | 13 | 37 | 06 | 05.1 | 0 | 25 | 44.7 | | 31 | 38 | 57 | 33.1 | 0 | 24 | 40.2 |
| | 14 | 37 | 07 | 37.1 | 0 | 25 | 43.0 | Apr. | 1 | 39 | 00 | 41.6 | 0 | 24 | 39.1 |
| | 15 | 37 | 09 | 11.9 | -0 | 25 | 41.3 | | 2 | 39 | 03 | 51.5 | -0 | 24 | 38.1 |

**URANUS, 2021**
GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| Apr. | 1 | 39 | 00 | 41.6 | -0 | 24 | 39.1 | May | 17 | 41 | 36 | 21.2 | -0 | 24 | 12.6 |
| | 2 | 39 | 03 | 51.5 | 0 | 24 | 38.1 | | 18 | 41 | 39 | 43.4 | 0 | 24 | 12.4 |
| | 3 | 39 | 07 | 02.6 | 0 | 24 | 37.2 | | 19 | 41 | 43 | 04.8 | 0 | 24 | 12.3 |
| | 4 | 39 | 10 | 14.8 | 0 | 24 | 36.2 | | 20 | 41 | 46 | 25.5 | 0 | 24 | 12.2 |
| | 5 | 39 | 13 | 28.1 | 0 | 24 | 35.3 | | 21 | 41 | 49 | 45.3 | 0 | 24 | 12.1 |
| | 6 | 39 | 16 | 42.5 | 0 | 24 | 34.3 | | 22 | 41 | 53 | 04.3 | 0 | 24 | 12.1 |
| | 7 | 39 | 19 | 57.9 | -0 | 24 | 33.4 | | 23 | 41 | 56 | 22.4 | -0 | 24 | 12.0 |
| | 8 | 39 | 23 | 14.2 | 0 | 24 | 32.6 | | 24 | 41 | 59 | 39.6 | 0 | 24 | 12.0 |
| | 9 | 39 | 26 | 31.5 | 0 | 24 | 31.7 | | 25 | 42 | 02 | 56.0 | 0 | 24 | 12.0 |
| | 10 | 39 | 29 | 49.6 | 0 | 24 | 30.8 | | 26 | 42 | 06 | 11.5 | 0 | 24 | 12.0 |
| | 11 | 39 | 33 | 08.6 | 0 | 24 | 30.0 | | 27 | 42 | 09 | 26.1 | 0 | 24 | 12.0 |
| | 12 | 39 | 36 | 28.4 | 0 | 24 | 29.2 | | 28 | 42 | 12 | 39.7 | 0 | 24 | 12.1 |
| | 13 | 39 | 39 | 49.0 | -0 | 24 | 28.4 | | 29 | 42 | 15 | 52.3 | -0 | 24 | 12.1 |
| | 14 | 39 | 43 | 10.4 | 0 | 24 | 27.6 | | 30 | 42 | 19 | 03.8 | 0 | 24 | 12.2 |
| | 15 | 39 | 46 | 32.6 | 0 | 24 | 26.8 | | 31 | 42 | 22 | 14.1 | 0 | 24 | 12.3 |
| | 16 | 39 | 49 | 55.4 | 0 | 24 | 26.1 | June | 1 | 42 | 25 | 23.1 | 0 | 24 | 12.4 |
| | 17 | 39 | 53 | 18.9 | 0 | 24 | 25.4 | | 2 | 42 | 28 | 30.9 | 0 | 24 | 12.6 |
| | 18 | 39 | 56 | 42.9 | 0 | 24 | 24.6 | | 3 | 42 | 31 | 37.5 | 0 | 24 | 12.7 |
| | 19 | 40 | 00 | 07.5 | -0 | 24 | 24.0 | | 4 | 42 | 34 | 42.7 | -0 | 24 | 12.9 |
| | 20 | 40 | 03 | 32.5 | 0 | 24 | 23.3 | | 5 | 42 | 37 | 46.6 | 0 | 24 | 13.0 |
| | 21 | 40 | 06 | 58.0 | 0 | 24 | 22.6 | | 6 | 42 | 40 | 49.2 | 0 | 24 | 13.2 |
| | 22 | 40 | 10 | 23.8 | 0 | 24 | 22.0 | | 7 | 42 | 43 | 50.4 | 0 | 24 | 13.4 |
| | 23 | 40 | 13 | 49.9 | 0 | 24 | 21.4 | | 8 | 42 | 46 | 50.3 | 0 | 24 | 13.6 |
| | 24 | 40 | 17 | 16.2 | 0 | 24 | 20.8 | | 9 | 42 | 49 | 48.7 | 0 | 24 | 13.9 |
| | 25 | 40 | 20 | 42.9 | -0 | 24 | 20.3 | | 10 | 42 | 52 | 45.6 | -0 | 24 | 14.1 |
| | 26 | 40 | 24 | 09.7 | 0 | 24 | 19.7 | | 11 | 42 | 55 | 41.0 | 0 | 24 | 14.4 |
| | 27 | 40 | 27 | 36.8 | 0 | 24 | 19.2 | | 12 | 42 | 58 | 34.9 | 0 | 24 | 14.7 |
| | 28 | 40 | 31 | 04.1 | 0 | 24 | 18.7 | | 13 | 43 | 01 | 27.1 | 0 | 24 | 15.0 |
| | 29 | 40 | 34 | 31.7 | 0 | 24 | 18.3 | | 14 | 43 | 04 | 17.6 | 0 | 24 | 15.3 |
| | 30 | 40 | 37 | 59.5 | 0 | 24 | 18.0 | | 15 | 43 | 07 | 06.5 | 0 | 24 | 15.6 |
| May | 1 | 40 | 41 | 26.4 | -0 | 24 | 18.2 | | 16 | 43 | 09 | 53.5 | -0 | 24 | 16.0 |
| | 2 | 40 | 44 | 54.1 | 0 | 24 | 17.0 | | 17 | 43 | 12 | 38.8 | 0 | 24 | 16.3 |
| | 3 | 40 | 48 | 21.9 | 0 | 24 | 16.5 | | 18 | 43 | 15 | 22.2 | 0 | 24 | 16.7 |
| | 4 | 40 | 51 | 49.5 | 0 | 24 | 16.1 | | 19 | 43 | 18 | 03.8 | 0 | 24 | 17.1 |
| | 5 | 40 | 55 | 16.9 | 0 | 24 | 15.7 | | 20 | 43 | 20 | 43.6 | 0 | 24 | 17.5 |
| | 6 | 40 | 58 | 44.0 | 0 | 24 | 15.3 | | 21 | 43 | 23 | 21.5 | 0 | 24 | 17.9 |
| | 7 | 41 | 02 | 11.0 | -0 | 24 | 15.0 | | 22 | 43 | 25 | 57.6 | -0 | 24 | 18.3 |
| | 8 | 41 | 05 | 37.7 | 0 | 24 | 14.7 | | 23 | 43 | 28 | 31.8 | 0 | 24 | 18.8 |
| | 9 | 41 | 09 | 04.1 | 0 | 24 | 14.4 | | 24 | 43 | 31 | 04.1 | 0 | 24 | 19.3 |
| | 10 | 41 | 12 | 30.2 | 0 | 24 | 14.1 | | 25 | 43 | 33 | 34.4 | 0 | 24 | 19.7 |
| | 11 | 41 | 15 | 56.0 | 0 | 24 | 13.8 | | 26 | 43 | 36 | 02.7 | 0 | 24 | 20.2 |
| | 12 | 41 | 19 | 21.4 | 0 | 24 | 13.6 | | 27 | 43 | 38 | 28.9 | 0 | 24 | 20.7 |
| | 13 | 41 | 22 | 46.4 | -0 | 24 | 13.3 | | 28 | 43 | 40 | 53.0 | -0 | 24 | 21.2 |
| | 14 | 41 | 26 | 10.9 | 0 | 24 | 13.1 | | 29 | 43 | 43 | 14.9 | 0 | 24 | 21.8 |
| | 15 | 41 | 29 | 34.9 | 0 | 24 | 12.9 | | 30 | 43 | 45 | 34.7 | 0 | 24 | 22.3 |
| | 16 | 41 | 32 | 58.4 | 0 | 24 | 12.7 | July | 1 | 43 | 47 | 52.2 | 0 | 24 | 22.9 |
| | 17 | 41 | 36 | 21.2 | -0 | 24 | 12.6 | | 2 | 43 | 50 | 07.5 | -0 | 24 | 23.4 |

**URANUS, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude ° | ' | " | Apparent Geocentric Latitude ° | ' | " | Date | | Apparent Geocentric Longitude ° | ' | " | Apparent Geocentric Latitude ° | ' | " |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| July | 1 | 43 | 47 | 52.2 | -0 | 24 | 22.9 | Aug. | 16 | 44 | 47 | 10.3 | -0 | 24 | 56.6 |
| | 2 | 43 | 50 | 07.5 | 0 | 24 | 23.4 | | 17 | 44 | 47 | 20.9 | 0 | 24 | 57.4 |
| | 3 | 43 | 52 | 20.7 | 0 | 24 | 24.0 | | 18 | 44 | 47 | 28.6 | 0 | 24 | 58.2 |
| | 4 | 43 | 54 | 31.5 | 0 | 24 | 24.6 | | 19 | 44 | 47 | 33.3 | 0 | 24 | 59.0 |
| | 5 | 43 | 56 | 40.1 | 0 | 24 | 25.1 | | 20 | 44 | 47 | 35.0 | 0 | 24 | 59.8 |
| | 6 | 43 | 58 | 46.5 | 0 | 24 | 25.7 | | 21 | 44 | 47 | 33.7 | 0 | 25 | 00.6 |
| | 7 | 44 | 00 | 50.5 | -0 | 24 | 26.3 | | 22 | 44 | 47 | 29.4 | -0 | 25 | 01.4 |
| | 8 | 44 | 02 | 52.2 | 0 | 24 | 27.0 | | 23 | 44 | 47 | 22.1 | 0 | 25 | 02.2 |
| | 9 | 44 | 04 | 51.4 | 0 | 24 | 27.6 | | 24 | 44 | 47 | 11.7 | 0 | 25 | 03.0 |
| | 10 | 44 | 06 | 48.3 | 0 | 24 | 28.2 | | 25 | 44 | 46 | 58.4 | 0 | 25 | 03.8 |
| | 11 | 44 | 08 | 42.6 | 0 | 24 | 28.9 | | 26 | 44 | 46 | 42.1 | 0 | 25 | 04.5 |
| | 12 | 44 | 10 | 34.5 | 0 | 24 | 29.5 | | 27 | 44 | 46 | 22.9 | 0 | 25 | 05.3 |
| | 13 | 44 | 12 | 23.7 | -0 | 24 | 30.2 | | 28 | 44 | 46 | 00.7 | -0 | 25 | 06.1 |
| | 14 | 44 | 14 | 10.4 | 0 | 24 | 30.9 | | 29 | 44 | 45 | 35.7 | 0 | 25 | 06.8 |
| | 15 | 44 | 15 | 54.5 | 0 | 24 | 31.6 | | 30 | 44 | 45 | 07.8 | 0 | 25 | 07.6 |
| | 16 | 44 | 17 | 36.0 | 0 | 24 | 32.3 | | 31 | 44 | 44 | 36.9 | 0 | 25 | 08.3 |
| | 17 | 44 | 19 | 14.8 | 0 | 24 | 33.0 | Sept. | 1 | 44 | 44 | 03.2 | 0 | 25 | 09.0 |
| | 18 | 44 | 20 | 51.1 | 0 | 24 | 33.7 | | 2 | 44 | 43 | 26.6 | 0 | 25 | 09.7 |
| | 19 | 44 | 22 | 24.8 | -0 | 24 | 34.5 | | 3 | 44 | 42 | 47.1 | -0 | 25 | 10.5 |
| | 20 | 44 | 23 | 55.9 | 0 | 24 | 35.2 | | 4 | 44 | 42 | 04.8 | 0 | 25 | 11.2 |
| | 21 | 44 | 25 | 24.4 | 0 | 24 | 35.9 | | 5 | 44 | 41 | 19.5 | 0 | 25 | 11.9 |
| | 22 | 44 | 26 | 50.2 | 0 | 24 | 36.7 | | 6 | 44 | 40 | 31.3 | 0 | 25 | 12.5 |
| | 23 | 44 | 28 | 13.3 | 0 | 24 | 37.4 | | 7 | 44 | 39 | 40.2 | 0 | 25 | 13.2 |
| | 24 | 44 | 29 | 33.7 | 0 | 24 | 38.2 | | 8 | 44 | 38 | 46.3 | 0 | 25 | 13.9 |
| | 25 | 44 | 30 | 51.2 | -0 | 24 | 39.0 | | 9 | 44 | 37 | 49.6 | -0 | 25 | 14.6 |
| | 26 | 44 | 32 | 06.0 | 0 | 24 | 39.7 | | 10 | 44 | 36 | 50.1 | 0 | 25 | 15.2 |
| | 27 | 44 | 33 | 17.9 | 0 | 24 | 40.5 | | 11 | 44 | 35 | 48.0 | 0 | 25 | 15.9 |
| | 28 | 44 | 34 | 27.0 | 0 | 24 | 41.3 | | 12 | 44 | 34 | 43.2 | 0 | 25 | 16.5 |
| | 29 | 44 | 35 | 33.3 | 0 | 24 | 42.1 | | 13 | 44 | 33 | 35.8 | 0 | 25 | 17.1 |
| | 30 | 44 | 36 | 36.7 | 0 | 24 | 42.9 | | 14 | 44 | 32 | 25.8 | 0 | 25 | 17.7 |
| | 31 | 44 | 37 | 37.3 | -0 | 24 | 43.6 | | 15 | 44 | 31 | 13.2 | -0 | 25 | 18.3 |
| Aug. | 1 | 44 | 38 | 35.1 | 0 | 24 | 44.4 | | 16 | 44 | 29 | 58.0 | 0 | 25 | 18.9 |
| | 2 | 44 | 39 | 30.1 | 0 | 24 | 45.2 | | 17 | 44 | 28 | 40.2 | 0 | 25 | 19.4 |
| | 3 | 44 | 40 | 22.2 | 0 | 24 | 46.0 | | 18 | 44 | 27 | 19.8 | 0 | 25 | 20.0 |
| | 4 | 44 | 41 | 11.4 | 0 | 24 | 46.8 | | 19 | 44 | 25 | 56.9 | 0 | 25 | 20.5 |
| | 5 | 44 | 41 | 57.7 | 0 | 24 | 47.6 | | 20 | 44 | 24 | 31.5 | 0 | 25 | 21.0 |
| | 6 | 44 | 42 | 41.1 | -0 | 24 | 48.4 | | 21 | 44 | 23 | 03.6 | -0 | 25 | 21.5 |
| | 7 | 44 | 43 | 21.5 | 0 | 24 | 49.2 | | 22 | 44 | 21 | 33.3 | 0 | 25 | 22.0 |
| | 8 | 44 | 43 | 59.0 | 0 | 24 | 50.0 | | 23 | 44 | 20 | 00.6 | 0 | 25 | 22.5 |
| | 9 | 44 | 44 | 33.4 | 0 | 24 | 50.9 | | 24 | 44 | 18 | 25.7 | 0 | 25 | 22.9 |
| | 10 | 44 | 45 | 04.8 | 0 | 24 | 51.7 | | 25 | 44 | 16 | 48.4 | 0 | 25 | 23.3 |
| | 11 | 44 | 45 | 33.2 | 0 | 24 | 52.5 | | 26 | 44 | 15 | 09.0 | 0 | 25 | 23.7 |
| | 12 | 44 | 45 | 58.6 | +0 | 24 | 53.3 | | 27 | 44 | 13 | 27.3 | -0 | 25 | 24.1 |
| | 13 | 44 | 46 | 20.9 | 0 | 24 | 54.1 | | 28 | 44 | 11 | 43.5 | 0 | 25 | 24.5 |
| | 14 | 44 | 46 | 40.3 | 0 | 24 | 54.9 | | 29 | 44 | 09 | 57.6 | 0 | 25 | 24.9 |
| | 15 | 44 | 46 | 56.8 | 0 | 24 | 55.8 | | 30 | 44 | 08 | 09.5 | 0 | 25 | 25.2 |
| | 16 | 44 | 47 | 10.3 | -0 | 24 | 56.6 | Oct. | 1 | 44 | 06 | 19.3 | -0 | 25 | 25.5 |

**URANUS, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " |
| Oct. | 1 | 44 | 06 | 19.3 | -0 | 25 | 25.5 |
| | 2 | 44 | 04 | 27.1 | 0 | 25 | 25.8 |
| | 3 | 44 | 02 | 32.9 | 0 | 25 | 26.1 |
| | 4 | 44 | 00 | 36.6 | 0 | 25 | 26.4 |
| | 5 | 43 | 58 | 38.5 | 0 | 25 | 26.6 |
| | 6 | 43 | 56 | 38.4 | 0 | 25 | 26.8 |
| | 7 | 43 | 54 | 36.6 | -0 | 25 | 27.0 |
| | 8 | 43 | 52 | 33.1 | 0 | 25 | 27.2 |
| | 9 | 43 | 50 | 27.9 | 0 | 25 | 27.4 |
| | 10 | 43 | 48 | 21.2 | 0 | 25 | 27.5 |
| | 11 | 43 | 46 | 13.0 | 0 | 25 | 27.7 |
| | 12 | 43 | 44 | 03.3 | 0 | 25 | 27.8 |
| | 13 | 43 | 41 | 52.1 | -0 | 25 | 27.8 |
| | 14 | 43 | 39 | 39.5 | 0 | 25 | 27.9 |
| | 15 | 43 | 37 | 25.5 | 0 | 25 | 27.9 |
| | 16 | 43 | 35 | 10.2 | 0 | 25 | 27.9 |
| | 17 | 43 | 32 | 53.6 | 0 | 25 | 27.9 |
| | 18 | 43 | 30 | 35.7 | 0 | 25 | 27.9 |
| | 19 | 43 | 28 | 16.8 | -0 | 25 | 27.8 |
| | 20 | 43 | 25 | 56.8 | 0 | 25 | 27.7 |
| | 21 | 43 | 23 | 35.8 | 0 | 25 | 27.6 |
| | 22 | 43 | 21 | 13.9 | 0 | 25 | 27.4 |
| | 23 | 43 | 18 | 51.1 | 0 | 25 | 27.3 |
| | 24 | 43 | 16 | 27.5 | 0 | 25 | 27.1 |
| | 25 | 43 | 14 | 03.2 | -0 | 25 | 26.8 |
| | 26 | 43 | 11 | 38.2 | 0 | 25 | 26.6 |
| | 27 | 43 | 09 | 12.6 | 0 | 25 | 26.3 |
| | 28 | 43 | 06 | 46.3 | 0 | 25 | 26.0 |
| | 29 | 43 | 04 | 19.5 | 0 | 25 | 25.7 |
| | 30 | 43 | 01 | 52.1 | 0 | 25 | 25.4 |
| | 31 | 42 | 59 | 24.4 | -0 | 25 | 25.0 |
| Nov. | 1 | 42 | 56 | 56.2 | 0 | 25 | 24.6 |
| | 2 | 42 | 54 | 27.7 | 0 | 25 | 24.2 |
| | 3 | 42 | 51 | 59.0 | 0 | 25 | 23.8 |
| | 4 | 42 | 49 | 30.2 | 0 | 25 | 23.3 |
| | 5 | 42 | 47 | 01.3 | 0 | 25 | 22.9 |
| | 6 | 42 | 44 | 32.6 | -0 | 25 | 22.4 |
| | 7 | 42 | 42 | 03.9 | 0 | 25 | 21.8 |
| | 8 | 42 | 39 | 35.5 | 0 | 25 | 21.3 |
| | 9 | 42 | 37 | 07.3 | 0 | 25 | 20.7 |
| | 10 | 42 | 34 | 39.3 | 0 | 25 | 20.1 |
| | 11 | 42 | 32 | 11.6 | 0 | 25 | 19.4 |
| | 12 | 42 | 29 | 44.2 | +0 | 25 | 18.8 |
| | 13 | 42 | 27 | 17.3 | 0 | 25 | 18.1 |
| | 14 | 42 | 24 | 50.8 | 0 | 25 | 17.4 |
| | 15 | 42 | 22 | 25.0 | 0 | 25 | 16.6 |
| | 16 | 42 | 19 | 59.8 | -0 | 25 | 15.9 |

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " |
| Nov. | 16 | 42 | 19 | 59.8 | -0 | 25 | 15.9 |
| | 17 | 42 | 17 | 35.3 | 0 | 25 | 15.1 |
| | 18 | 42 | 15 | 11.6 | 0 | 25 | 14.2 |
| | 19 | 42 | 12 | 48.9 | 0 | 25 | 13.4 |
| | 20 | 42 | 10 | 27.0 | 0 | 25 | 12.5 |
| | 21 | 42 | 08 | 06.2 | 0 | 25 | 11.6 |
| | 22 | 42 | 05 | 46.4 | -0 | 25 | 10.7 |
| | 23 | 42 | 03 | 27.7 | 0 | 25 | 09.8 |
| | 24 | 42 | 01 | 10.1 | 0 | 25 | 08.8 |
| | 25 | 41 | 58 | 53.7 | 0 | 25 | 07.9 |
| | 26 | 41 | 56 | 38.6 | 0 | 25 | 06.9 |
| | 27 | 41 | 54 | 24.7 | 0 | 25 | 05.8 |
| | 28 | 41 | 52 | 12.1 | -0 | 25 | 04.8 |
| | 29 | 41 | 50 | 01.0 | 0 | 25 | 03.7 |
| | 30 | 41 | 47 | 51.3 | 0 | 25 | 02.6 |
| Dec. | 1 | 41 | 45 | 43.2 | 0 | 25 | 01.5 |
| | 2 | 41 | 43 | 36.8 | 0 | 25 | 00.4 |
| | 3 | 41 | 41 | 32.1 | 0 | 24 | 59.3 |
| | 4 | 41 | 39 | 29.2 | -0 | 24 | 58.1 |
| | 5 | 41 | 37 | 28.2 | 0 | 24 | 56.9 |
| | 6 | 41 | 35 | 29.1 | 0 | 24 | 55.7 |
| | 7 | 41 | 33 | 31.8 | 0 | 24 | 54.5 |
| | 8 | 41 | 31 | 36.5 | 0 | 24 | 53.2 |
| | 9 | 41 | 29 | 43.2 | 0 | 24 | 52.0 |
| | 10 | 41 | 27 | 51.8 | -0 | 24 | 50.7 |
| | 11 | 41 | 26 | 02.5 | 0 | 24 | 49.4 |
| | 12 | 41 | 24 | 15.4 | 0 | 24 | 48.0 |
| | 13 | 41 | 22 | 30.5 | 0 | 24 | 46.7 |
| | 14 | 41 | 20 | 47.8 | 0 | 24 | 45.3 |
| | 15 | 41 | 19 | 07.4 | 0 | 24 | 43.9 |
| | 16 | 41 | 17 | 29.5 | -0 | 24 | 42.5 |
| | 17 | 41 | 15 | 53.9 | 0 | 24 | 41.1 |
| | 18 | 41 | 14 | 20.8 | 0 | 24 | 39.7 |
| | 19 | 41 | 12 | 50.1 | 0 | 24 | 38.2 |
| | 20 | 41 | 11 | 22.0 | 0 | 24 | 36.8 |
| | 21 | 41 | 09 | 56.3 | 0 | 24 | 35.3 |
| | 22 | 41 | 08 | 33.3 | -0 | 24 | 33.8 |
| | 23 | 41 | 07 | 12.7 | 0 | 24 | 32.3 |
| | 24 | 41 | 05 | 54.8 | 0 | 24 | 30.8 |
| | 25 | 41 | 04 | 39.5 | 0 | 24 | 29.3 |
| | 26 | 41 | 03 | 26.8 | 0 | 24 | 27.7 |
| | 27 | 41 | 02 | 16.9 | 0 | 24 | 26.2 |
| | 28 | 41 | 01 | 09.7 | -0 | 24 | 24.6 |
| | 29 | 41 | 00 | 05.4 | 0 | 24 | 23.1 |
| | 30 | 40 | 59 | 03.9 | 0 | 24 | 21.5 |
| | 31 | 40 | 58 | 05.4 | 0 | 24 | 19.9 |
| | 32 | 40 | 57 | 09.9 | -0 | 24 | 18.3 |

**URANUS, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Jan. | 0 | 2 | 18 | 30.65 | +13 | 21 | 39.9 | 19.305 826 | 0.46 | 1.81 | 19 | 35 | 44 |
| | 1 | 2 | 18 | 27.84 | 13 | 21 | 27.6 | 19.321 175 | 0.46 | 1.81 | 19 | 31 | 46 |
| | 2 | 2 | 18 | 25.22 | 13 | 21 | 16.3 | 19.336 657 | 0.45 | 1.81 | 19 | 27 | 47 |
| | 3 | 2 | 18 | 22.80 | 13 | 21 | 05.9 | 19.352 270 | 0.45 | 1.81 | 19 | 23 | 49 |
| | 4 | 2 | 18 | 20.56 | 13 | 20 | 56.5 | 19.368 007 | 0.45 | 1.81 | 19 | 19 | 51 |
| | 5 | 2 | 18 | 18.52 | 13 | 20 | 48.1 | 19.383 864 | 0.45 | 1.81 | 19 | 15 | 53 |
| | 6 | 2 | 18 | 16.67 | +13 | 20 | 40.7 | 19.399 836 | 0.45 | 1.81 | 19 | 11 | 56 |
| | 7 | 2 | 18 | 15.03 | 13 | 20 | 34.3 | 19.415 919 | 0.45 | 1.80 | 19 | 07 | 58 |
| | 8 | 2 | 18 | 13.59 | 13 | 20 | 28.9 | 19.432 106 | 0.45 | 1.80 | 19 | 04 | 01 |
| | 9 | 2 | 18 | 12.35 | 13 | 20 | 24.5 | 19.448 394 | 0.45 | 1.80 | 19 | 00 | 04 |
| | 10 | 2 | 18 | 11.32 | 13 | 20 | 21.2 | 19.464 776 | 0.45 | 1.80 | 18 | 56 | 07 |
| | 11 | 2 | 18 | 10.50 | 13 | 20 | 18.9 | 19.481 247 | 0.45 | 1.80 | 18 | 52 | 11 |
| | 12 | 2 | 18 | 09.88 | +13 | 20 | 17.7 | 19.497 801 | 0.45 | 1.80 | 18 | 48 | 15 |
| | 13 | 2 | 18 | 09.46 | 13 | 20 | 17.5 | 19.514 434 | 0.45 | 1.79 | 18 | 44 | 18 |
| | 14 | 2 | 18 | 09.24 | 13 | 20 | 18.4 | 19.531 139 | 0.45 | 1.79 | 18 | 40 | 22 |
| | 15 | 2 | 18 | 09.23 | 13 | 20 | 20.3 | 19.547 911 | 0.45 | 1.79 | 18 | 36 | 27 |
| | 16 | 2 | 18 | 09.42 | 13 | 20 | 23.2 | 19.564 743 | 0.45 | 1.79 | 18 | 32 | 31 |
| | 17 | 2 | 18 | 09.81 | 13 | 20 | 27.2 | 19.581 630 | 0.45 | 1.79 | 18 | 28 | 36 |
| | 18 | 2 | 18 | 10.40 | +13 | 20 | 32.1 | 19.598 567 | 0.45 | 1.79 | 18 | 24 | 41 |
| | 19 | 2 | 18 | 11.20 | 13 | 20 | 38.1 | 19.615 548 | 0.45 | 1.79 | 18 | 20 | 46 |
| | 20 | 2 | 18 | 12.21 | 13 | 20 | 45.2 | 19.632 567 | 0.45 | 1.78 | 18 | 16 | 51 |
| | 21 | 2 | 18 | 13.42 | 13 | 20 | 53.2 | 19.649 619 | 0.45 | 1.78 | 18 | 12 | 56 |
| | 22 | 2 | 18 | 14.83 | 13 | 21 | 02.3 | 19.666 699 | 0.45 | 1.78 | 18 | 09 | 02 |
| | 23 | 2 | 18 | 16.46 | 13 | 21 | 12.5 | 19.683 801 | 0.45 | 1.78 | 18 | 05 | 08 |
| | 24 | 2 | 18 | 18.29 | +13 | 21 | 23.7 | 19.700 921 | 0.45 | 1.78 | 18 | 01 | 14 |
| | 25 | 2 | 18 | 20.32 | 13 | 21 | 35.9 | 19.718 052 | 0.45 | 1.78 | 17 | 57 | 20 |
| | 26 | 2 | 18 | 22.56 | 13 | 21 | 49.2 | 19.735 190 | 0.45 | 1.77 | 17 | 53 | 27 |
| | 27 | 2 | 18 | 25.00 | 13 | 22 | 03.4 | 19.752 330 | 0.45 | 1.77 | 17 | 49 | 33 |
| | 28 | 2 | 18 | 27.64 | 13 | 22 | 18.8 | 19.769 467 | 0.44 | 1.77 | 17 | 45 | 40 |
| | 29 | 2 | 18 | 30.47 | 13 | 22 | 35.1 | 19.786 596 | 0.44 | 1.77 | 17 | 41 | 47 |
| | 30 | 2 | 18 | 33.51 | +13 | 22 | 52.4 | 19.803 712 | 0.44 | 1.77 | 17 | 37 | 54 |
| | 31 | 2 | 18 | 36.74 | 13 | 23 | 10.6 | 19.820 811 | 0.44 | 1.77 | 17 | 34 | 02 |
| Feb. | 1 | 2 | 18 | 40.16 | 13 | 23 | 29.9 | 19.837 887 | 0.44 | 1.77 | 17 | 30 | 09 |
| | 2 | 2 | 18 | 43.78 | 13 | 23 | 50.1 | 19.854 936 | 0.44 | 1.76 | 17 | 26 | 17 |
| | 3 | 2 | 18 | 47.60 | 13 | 24 | 11.3 | 19.871 952 | 0.44 | 1.76 | 17 | 22 | 25 |
| | 4 | 2 | 18 | 51.62 | 13 | 24 | 33.5 | 19.888 932 | 0.44 | 1.76 | 17 | 18 | 34 |
| | 5 | 2 | 18 | 55.84 | +13 | 24 | 56.6 | 19.905 870 | 0.44 | 1.76 | 17 | 14 | 42 |
| | 6 | 2 | 19 | 00.25 | 13 | 25 | 20.7 | 19.922 761 | 0.44 | 1.76 | 17 | 10 | 51 |
| | 7 | 2 | 19 | 04.87 | 13 | 25 | 45.8 | 19.939 600 | 0.44 | 1.76 | 17 | 06 | 59 |
| | 8 | 2 | 19 | 09.67 | 13 | 26 | 11.9 | 19.956 382 | 0.44 | 1.75 | 17 | 03 | 08 |
| | 9 | 2 | 19 | 14.67 | 13 | 26 | 39.0 | 19.973 101 | 0.44 | 1.75 | 16 | 59 | 18 |
| | 10 | 2 | 19 | 19.86 | 13 | 27 | 07.0 | 19.989 752 | 0.44 | 1.75 | 16 | 55 | 27 |
| | 11 | 2 | 19 | 25.23 | +13 | 27 | 36.0 | 20.006 330 | 0.44 | 1.75 | 16 | 51 | 37 |
| | 12 | 2 | 19 | 30.79 | 13 | 28 | 05.8 | 20.022 830 | 0.44 | 1.75 | 16 | 47 | 46 |
| | 13 | 2 | 19 | 36.53 | 13 | 28 | 36.6 | 20.039 246 | 0.44 | 1.75 | 16 | 43 | 56 |
| | 14 | 2 | 19 | 42.46 | 13 | 29 | 08.3 | 20.055 574 | 0.44 | 1.75 | 16 | 40 | 06 |
| | 15 | 2 | 19 | 48.57 | +13 | 29 | 40.8 | 20.071 808 | 0.44 | 1.74 | 16 | 36 | 17 |

**URANUS, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Feb. | 15 | 2 | 19 | 48.57 | +13 | 29 | 40.8 | 20.071 808 | 0.44 | 1.74 | 16 | 36 | 17 |
| | 16 | 2 | 19 | 54.86 | 13 | 30 | 14.2 | 20.087 944 | 0.44 | 1.74 | 16 | 32 | 27 |
| | 17 | 2 | 20 | 01.33 | 13 | 30 | 48.5 | 20.103 978 | 0.44 | 1.74 | 16 | 28 | 38 |
| | 18 | 2 | 20 | 07.98 | 13 | 31 | 23.7 | 20.119 903 | 0.44 | 1.74 | 16 | 24 | 49 |
| | 19 | 2 | 20 | 14.81 | 13 | 31 | 59.8 | 20.135 717 | 0.44 | 1.74 | 16 | 20 | 60 |
| | 20 | 2 | 20 | 21.81 | 13 | 32 | 36.7 | 20.151 414 | 0.44 | 1.74 | 16 | 17 | 11 |
| | 21 | 2 | 20 | 29.00 | +13 | 33 | 14.4 | 20.166 990 | 0.44 | 1.74 | 16 | 13 | 22 |
| | 22 | 2 | 20 | 36.35 | 13 | 33 | 53.0 | 20.182 442 | 0.44 | 1.74 | 16 | 09 | 34 |
| | 23 | 2 | 20 | 43.87 | 13 | 34 | 32.5 | 20.197 764 | 0.44 | 1.73 | 16 | 05 | 45 |
| | 24 | 2 | 20 | 51.56 | 13 | 35 | 12.7 | 20.212 953 | 0.44 | 1.73 | 16 | 01 | 57 |
| | 25 | 2 | 20 | 59.42 | 13 | 35 | 53.8 | 20.228 006 | 0.43 | 1.73 | 15 | 58 | 09 |
| | 26 | 2 | 21 | 07.43 | 13 | 36 | 35.6 | 20.242 918 | 0.43 | 1.73 | 15 | 54 | 21 |
| | 27 | 2 | 21 | 15.60 | +13 | 37 | 18.2 | 20.257 685 | 0.43 | 1.73 | 15 | 50 | 34 |
| | 28 | 2 | 21 | 23.93 | 13 | 38 | 01.5 | 20.272 304 | 0.43 | 1.73 | 15 | 46 | 46 |
| Mar. | 1 | 2 | 21 | 32.41 | 13 | 38 | 45.5 | 20.286 772 | 0.43 | 1.73 | 15 | 42 | 59 |
| | 2 | 2 | 21 | 41.05 | 13 | 39 | 30.3 | 20.301 085 | 0.43 | 1.73 | 15 | 39 | 12 |
| | 3 | 2 | 21 | 49.84 | 13 | 40 | 15.7 | 20.315 239 | 0.43 | 1.72 | 15 | 35 | 25 |
| | 4 | 2 | 21 | 58.79 | 13 | 41 | 01.9 | 20.329 230 | 0.43 | 1.72 | 15 | 31 | 38 |
| | 5 | 2 | 22 | 07.89 | +13 | 41 | 48.9 | 20.343 056 | 0.43 | 1.72 | 15 | 27 | 51 |
| | 6 | 2 | 22 | 17.14 | 13 | 42 | 36.5 | 20.356 711 | 0.43 | 1.72 | 15 | 24 | 04 |
| | 7 | 2 | 22 | 26.54 | 13 | 43 | 24.8 | 20.370 193 | 0.43 | 1.72 | 15 | 20 | 18 |
| | 8 | 2 | 22 | 36.09 | 13 | 44 | 13.9 | 20.383 496 | 0.43 | 1.72 | 15 | 16 | 31 |
| | 9 | 2 | 22 | 45.77 | 13 | 45 | 03.6 | 20.396 619 | 0.43 | 1.72 | 15 | 12 | 45 |
| | 10 | 2 | 22 | 55.59 | 13 | 45 | 53.9 | 20.409 555 | 0.43 | 1.72 | 15 | 08 | 59 |
| | 11 | 2 | 23 | 05.55 | +13 | 46 | 44.9 | 20.422 303 | 0.43 | 1.71 | 15 | 05 | 13 |
| | 12 | 2 | 23 | 15.64 | 13 | 47 | 36.4 | 20.434 858 | 0.43 | 1.71 | 15 | 01 | 28 |
| | 13 | 2 | 23 | 25.86 | 13 | 48 | 28.6 | 20.447 217 | 0.43 | 1.71 | 14 | 57 | 42 |
| | 14 | 2 | 23 | 36.20 | 13 | 49 | 21.3 | 20.459 376 | 0.43 | 1.71 | 14 | 53 | 56 |
| | 15 | 2 | 23 | 46.68 | 13 | 50 | 14.6 | 20.471 332 | 0.43 | 1.71 | 14 | 50 | 11 |
| | 16 | 2 | 23 | 57.28 | 13 | 51 | 08.5 | 20.483 082 | 0.43 | 1.71 | 14 | 46 | 26 |
| | 17 | 2 | 24 | 08.00 | +13 | 52 | 02.9 | 20.494 623 | 0.43 | 1.71 | 14 | 42 | 40 |
| | 18 | 2 | 24 | 18.85 | 13 | 52 | 57.9 | 20.505 951 | 0.43 | 1.71 | 14 | 38 | 55 |
| | 19 | 2 | 24 | 29.82 | 13 | 53 | 53.4 | 20.517 064 | 0.43 | 1.71 | 14 | 35 | 11 |
| | 20 | 2 | 24 | 40.91 | 13 | 54 | 49.4 | 20.527 960 | 0.43 | 1.71 | 14 | 31 | 26 |
| | 21 | 2 | 24 | 52.10 | 13 | 55 | 46.0 | 20.538 635 | 0.43 | 1.71 | 14 | 27 | 41 |
| | 22 | 2 | 25 | 03.41 | 13 | 56 | 43.0 | 20.549 088 | 0.43 | 1.70 | 14 | 23 | 56 |
| | 23 | 2 | 25 | 14.83 | +13 | 57 | 40.5 | 20.559 315 | 0.43 | 1.70 | 14 | 20 | 12 |
| | 24 | 2 | 25 | 26.35 | 13 | 58 | 38.5 | 20.569 315 | 0.43 | 1.70 | 14 | 16 | 28 |
| | 25 | 2 | 25 | 37.97 | 13 | 59 | 36.9 | 20.579 086 | 0.43 | 1.70 | 14 | 12 | 43 |
| | 26 | 2 | 25 | 49.68 | 14 | 00 | 35.7 | 20.588 625 | 0.43 | 1.70 | 14 | 08 | 59 |
| | 27 | 2 | 26 | 01.49 | 14 | 01 | 35.0 | 20.597 931 | 0.43 | 1.70 | 14 | 05 | 15 |
| | 28 | 2 | 26 | 13.39 | 14 | 02 | 34.5 | 20.607 002 | 0.43 | 1.70 | 14 | 01 | 31 |
| | 29 | 2 | 26 | 25.38 | +14 | 03 | 34.5 | 20.615 836 | 0.43 | 1.70 | 13 | 57 | 47 |
| | 30 | 2 | 26 | 37.47 | 14 | 04 | 34.8 | 20.624 431 | 0.43 | 1.70 | 13 | 54 | 03 |
| | 31 | 2 | 26 | 49.64 | 14 | 05 | 35.5 | 20.632 786 | 0.43 | 1.70 | 13 | 50 | 19 |
| Apr. | 1 | 2 | 27 | 01.90 | 14 | 06 | 36.5 | 20.640 898 | 0.43 | 1.70 | 13 | 46 | 36 |
| | 2 | 2 | 27 | 14.25 | +14 | 07 | 37.9 | 20.648 766 | 0.43 | 1.70 | 13 | 42 | 52 |

**URANUS, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Apr. | 1 | 2 | 27 | 01.90 | +14 | 06 | 36.5 | 20.640 898 | 0.43 | 1.70 | 13 | 46 | 36 |
| | 2 | 2 | 27 | 14.25 | 14 | 07 | 37.9 | 20.648 766 | 0.43 | 1.70 | 13 | 42 | 52 |
| | 3 | 2 | 27 | 26.68 | 14 | 08 | 39.6 | 20.656 387 | 0.43 | 1.70 | 13 | 39 | 09 |
| | 4 | 2 | 27 | 39.19 | 14 | 09 | 41.7 | 20.663 760 | 0.43 | 1.69 | 13 | 35 | 25 |
| | 5 | 2 | 27 | 51.77 | 14 | 10 | 44.0 | 20.670 882 | 0.43 | 1.69 | 13 | 31 | 42 |
| | 6 | 2 | 28 | 04.43 | 14 | 11 | 46.7 | 20.677 751 | 0.43 | 1.69 | 13 | 27 | 59 |
| | 7 | 2 | 28 | 17.15 | +14 | 12 | 49.6 | 20.684 366 | 0.43 | 1.69 | 13 | 24 | 15 |
| | 8 | 2 | 28 | 29.93 | 14 | 13 | 52.8 | 20.690 725 | 0.43 | 1.69 | 13 | 20 | 32 |
| | 9 | 2 | 28 | 42.78 | 14 | 14 | 56.1 | 20.696 826 | 0.42 | 1.69 | 13 | 16 | 49 |
| | 10 | 2 | 28 | 55.69 | 14 | 15 | 59.7 | 20.702 667 | 0.42 | 1.69 | 13 | 13 | 06 |
| | 11 | 2 | 29 | 08.65 | 14 | 17 | 03.5 | 20.708 246 | 0.42 | 1.69 | 13 | 09 | 23 |
| | 12 | 2 | 29 | 21.68 | 14 | 18 | 07.5 | 20.713 564 | 0.42 | 1.69 | 13 | 05 | 40 |
| | 13 | 2 | 29 | 34.75 | +14 | 19 | 11.6 | 20.718 617 | 0.42 | 1.69 | 13 | 01 | 57 |
| | 14 | 2 | 29 | 47.89 | 14 | 20 | 16.0 | 20.723 405 | 0.42 | 1.69 | 12 | 58 | 15 |
| | 15 | 2 | 30 | 01.07 | 14 | 21 | 20.5 | 20.727 928 | 0.42 | 1.69 | 12 | 54 | 32 |
| | 16 | 2 | 30 | 14.30 | 14 | 22 | 25.1 | 20.732 184 | 0.42 | 1.69 | 12 | 50 | 49 |
| | 17 | 2 | 30 | 27.57 | 14 | 23 | 29.9 | 20.736 172 | 0.42 | 1.69 | 12 | 47 | 06 |
| | 18 | 2 | 30 | 40.88 | 14 | 24 | 34.8 | 20.739 892 | 0.42 | 1.69 | 12 | 43 | 24 |
| | 19 | 2 | 30 | 54.24 | +14 | 25 | 39.9 | 20.743 343 | 0.42 | 1.69 | 12 | 39 | 41 |
| | 20 | 2 | 31 | 07.62 | 14 | 26 | 45.0 | 20.746 525 | 0.42 | 1.69 | 12 | 35 | 58 |
| | 21 | 2 | 31 | 21.03 | 14 | 27 | 50.2 | 20.749 438 | 0.42 | 1.69 | 12 | 32 | 16 |
| | 22 | 2 | 31 | 34.47 | 14 | 28 | 55.4 | 20.752 081 | 0.42 | 1.69 | 12 | 28 | 33 |
| | 23 | 2 | 31 | 47.93 | 14 | 30 | 00.7 | 20.754 454 | 0.42 | 1.69 | 12 | 24 | 51 |
| | 24 | 2 | 32 | 01.41 | 14 | 31 | 05.9 | 20.756 558 | 0.42 | 1.69 | 12 | 21 | 08 |
| | 25 | 2 | 32 | 14.91 | +14 | 32 | 11.2 | 20.758 392 | 0.42 | 1.69 | 12 | 17 | 26 |
| | 26 | 2 | 32 | 28.43 | 14 | 33 | 16.5 | 20.759 957 | 0.42 | 1.69 | 12 | 13 | 44 |
| | 27 | 2 | 32 | 41.97 | 14 | 34 | 21.7 | 20.761 252 | 0.42 | 1.69 | 12 | 10 | 01 |
| | 28 | 2 | 32 | 55.53 | 14 | 35 | 26.9 | 20.762 277 | 0.42 | 1.69 | 12 | 06 | 19 |
| | 29 | 2 | 33 | 09.10 | 14 | 36 | 32.1 | 20.763 033 | 0.42 | 1.69 | 12 | 02 | 36 |
| | 30 | 2 | 33 | 22.70 | 14 | 37 | 37.2 | 20.763 519 | 0.42 | 1.69 | 11 | 58 | 54 |
| May | 1 | 2 | 33 | 36.25 | +14 | 38 | 41.5 | 20.763 735 | 0.42 | 1.69 | 11 | 55 | 11 |
| | 2 | 2 | 33 | 49.82 | 14 | 39 | 47.4 | 20.763 681 | 0.42 | 1.69 | 11 | 51 | 29 |
| | 3 | 2 | 34 | 03.42 | 14 | 40 | 52.6 | 20.763 357 | 0.42 | 1.69 | 11 | 47 | 47 |
| | 4 | 2 | 34 | 17.00 | 14 | 41 | 57.6 | 20.762 762 | 0.42 | 1.69 | 11 | 44 | 04 |
| | 5 | 2 | 34 | 30.58 | 14 | 43 | 02.4 | 20.761 896 | 0.42 | 1.69 | 11 | 40 | 22 |
| | 6 | 2 | 34 | 44.15 | 14 | 44 | 07.1 | 20.760 760 | 0.42 | 1.69 | 11 | 36 | 39 |
| | 7 | 2 | 34 | 57.70 | +14 | 45 | 11.7 | 20.759 353 | 0.42 | 1.69 | 11 | 32 | 57 |
| | 8 | 2 | 35 | 11.24 | 14 | 46 | 16.1 | 20.757 676 | 0.42 | 1.69 | 11 | 29 | 15 |
| | 9 | 2 | 35 | 24.77 | 14 | 47 | 20.3 | 20.755 729 | 0.42 | 1.69 | 11 | 25 | 32 |
| | 10 | 2 | 35 | 38.27 | 14 | 48 | 24.4 | 20.753 513 | 0.42 | 1.69 | 11 | 21 | 50 |
| | 11 | 2 | 35 | 51.76 | 14 | 49 | 28.3 | 20.751 029 | 0.42 | 1.69 | 11 | 18 | 07 |
| | 12 | 2 | 36 | 05.23 | 14 | 50 | 32.0 | 20.748 276 | 0.42 | 1.69 | 11 | 14 | 25 |
| | 13 | 2 | 36 | 18.67 | +14 | 51 | 35.5 | 20.745 256 | 0.42 | 1.69 | 11 | 10 | 42 |
| | 14 | 2 | 36 | 32.09 | 14 | 52 | 38.8 | 20.741 970 | 0.42 | 1.69 | 11 | 06 | 59 |
| | 15 | 2 | 36 | 45.47 | 14 | 53 | 41.9 | 20.738 419 | 0.42 | 1.69 | 11 | 03 | 17 |
| | 16 | 2 | 36 | 58.82 | 14 | 54 | 44.7 | 20.734 605 | 0.42 | 1.69 | 10 | 59 | 34 |
| | 17 | 2 | 37 | 12.13 | +14 | 55 | 47.4 | 20.730 527 | 0.42 | 1.69 | 10 | 55 | 51 |

**URANUS, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| May | 17 | 2 | 37 | 12.13 | +14 | 55 | 47.4 | 20.730 527 | 0.42 | 1.69 | 10 | 55 | 51 |
| | 18 | 2 | 37 | 25.40 | 14 | 56 | 49.7 | 20.726 189 | 0.42 | 1.69 | 10 | 52 | 09 |
| | 19 | 2 | 37 | 38.62 | 14 | 57 | 51.8 | 20.721 591 | 0.42 | 1.69 | 10 | 48 | 26 |
| | 20 | 2 | 37 | 51.80 | 14 | 58 | 53.5 | 20.716 734 | 0.42 | 1.69 | 10 | 44 | 43 |
| | 21 | 2 | 38 | 04.92 | 14 | 59 | 54.9 | 20.711 622 | 0.42 | 1.69 | 10 | 41 | 00 |
| | 22 | 2 | 38 | 17.99 | 15 | 00 | 56.0 | 20.706 254 | 0.42 | 1.69 | 10 | 37 | 17 |
| | 23 | 2 | 38 | 31.00 | +15 | 01 | 56.8 | 20.700 634 | 0.42 | 1.69 | 10 | 33 | 34 |
| | 24 | 2 | 38 | 43.97 | 15 | 02 | 57.2 | 20.694 762 | 0.42 | 1.69 | 10 | 29 | 51 |
| | 25 | 2 | 38 | 56.88 | 15 | 03 | 57.3 | 20.688 641 | 0.43 | 1.69 | 10 | 26 | 08 |
| | 26 | 2 | 39 | 09.73 | 15 | 04 | 57.0 | 20.682 273 | 0.43 | 1.69 | 10 | 22 | 25 |
| | 27 | 2 | 39 | 22.52 | 15 | 05 | 56.4 | 20.675 658 | 0.43 | 1.69 | 10 | 18 | 42 |
| | 28 | 2 | 39 | 35.26 | 15 | 06 | 55.4 | 20.668 798 | 0.43 | 1.69 | 10 | 14 | 59 |
| | 29 | 2 | 39 | 47.92 | +15 | 07 | 54.1 | 20.661 695 | 0.43 | 1.69 | 10 | 11 | 15 |
| | 30 | 2 | 40 | 00.52 | 15 | 08 | 52.4 | 20.654 350 | 0.43 | 1.70 | 10 | 07 | 32 |
| | 31 | 2 | 40 | 13.04 | 15 | 09 | 50.3 | 20.646 765 | 0.43 | 1.70 | 10 | 03 | 48 |
| June | 1 | 2 | 40 | 25.48 | 15 | 10 | 47.7 | 20.638 941 | 0.43 | 1.70 | 10 | 00 | 05 |
| | 2 | 2 | 40 | 37.84 | 15 | 11 | 44.7 | 20.630 880 | 0.43 | 1.70 | 9 | 56 | 21 |
| | 3 | 2 | 40 | 50.12 | 15 | 12 | 41.3 | 20.622 583 | 0.43 | 1.70 | 9 | 52 | 37 |
| | 4 | 2 | 41 | 02.31 | +15 | 13 | 37.4 | 20.614 052 | 0.43 | 1.70 | 9 | 48 | 54 |
| | 5 | 2 | 41 | 14.43 | 15 | 14 | 33.0 | 20.605 289 | 0.43 | 1.70 | 9 | 45 | 10 |
| | 6 | 2 | 41 | 26.45 | 15 | 15 | 28.2 | 20.596 297 | 0.43 | 1.70 | 9 | 41 | 26 |
| | 7 | 2 | 41 | 38.39 | 15 | 16 | 22.9 | 20.587 077 | 0.43 | 1.70 | 9 | 37 | 42 |
| | 8 | 2 | 41 | 50.24 | 15 | 17 | 17.1 | 20.577 631 | 0.43 | 1.70 | 9 | 33 | 57 |
| | 9 | 2 | 42 | 02.00 | 15 | 18 | 10.8 | 20.567 963 | 0.43 | 1.70 | 9 | 30 | 13 |
| | 10 | 2 | 42 | 13.66 | +15 | 19 | 04.0 | 20.558 074 | 0.43 | 1.70 | 9 | 26 | 29 |
| | 11 | 2 | 42 | 25.23 | 15 | 19 | 56.8 | 20.547 966 | 0.43 | 1.70 | 9 | 22 | 44 |
| | 12 | 2 | 42 | 36.69 | 15 | 20 | 49.0 | 20.537 644 | 0.43 | 1.71 | 9 | 18 | 60 |
| | 13 | 2 | 42 | 48.05 | 15 | 21 | 40.6 | 20.527 109 | 0.43 | 1.71 | 9 | 15 | 15 |
| | 14 | 2 | 42 | 59.30 | 15 | 22 | 31.8 | 20.516 365 | 0.43 | 1.71 | 9 | 11 | 30 |
| | 15 | 2 | 43 | 10.43 | 15 | 23 | 22.4 | 20.505 414 | 0.43 | 1.71 | 9 | 07 | 46 |
| | 16 | 2 | 43 | 21.46 | +15 | 24 | 12.3 | 20.494 260 | 0.43 | 1.71 | 9 | 04 | 01 |
| | 17 | 2 | 43 | 32.36 | 15 | 25 | 01.7 | 20.482 905 | 0.43 | 1.71 | 9 | 00 | 15 |
| | 18 | 2 | 43 | 43.15 | 15 | 25 | 50.5 | 20.471 352 | 0.43 | 1.71 | 8 | 56 | 30 |
| | 19 | 2 | 43 | 53.82 | 15 | 26 | 38.7 | 20.459 606 | 0.43 | 1.71 | 8 | 52 | 45 |
| | 20 | 2 | 44 | 04.37 | 15 | 27 | 26.3 | 20.447 669 | 0.43 | 1.71 | 8 | 48 | 59 |
| | 21 | 2 | 44 | 14.79 | 15 | 28 | 13.2 | 20.435 544 | 0.43 | 1.71 | 8 | 45 | 14 |
| | 22 | 2 | 44 | 25.10 | +15 | 28 | 59.6 | 20.423 235 | 0.43 | 1.71 | 8 | 41 | 28 |
| | 23 | 2 | 44 | 35.29 | 15 | 29 | 45.3 | 20.410 744 | 0.43 | 1.72 | 8 | 37 | 42 |
| | 24 | 2 | 44 | 45.35 | 15 | 30 | 30.4 | 20.398 075 | 0.43 | 1.72 | 8 | 33 | 56 |
| | 25 | 2 | 44 | 55.29 | 15 | 31 | 15.0 | 20.385 230 | 0.43 | 1.72 | 8 | 30 | 10 |
| | 26 | 2 | 45 | 05.09 | 15 | 31 | 58.9 | 20.372 213 | 0.43 | 1.72 | 8 | 26 | 24 |
| | 27 | 2 | 45 | 14.76 | 15 | 32 | 42.1 | 20.359 025 | 0.43 | 1.72 | 8 | 22 | 38 |
| | 28 | 2 | 45 | 24.28 | +15 | 33 | 24.7 | 20.345 671 | 0.43 | 1.72 | 8 | 18 | 51 |
| | 29 | 2 | 45 | 33.66 | 15 | 34 | 06.6 | 20.332 152 | 0.43 | 1.72 | 8 | 15 | 05 |
| | 30 | 2 | 45 | 42.90 | 15 | 34 | 47.8 | 20.318 473 | 0.43 | 1.72 | 8 | 11 | 18 |
| July | 1 | 2 | 45 | 52.00 | 15 | 35 | 28.3 | 20.304 635 | 0.43 | 1.72 | 8 | 07 | 31 |
| | 2 | 2 | 46 | 00.95 | +15 | 36 | 08.1 | 20.290 643 | 0.43 | 1.73 | 8 | 03 | 44 |

**URANUS, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| July | 1 | 2 | 45 | 52.00 | +15 | 35 | 28.3 | 20.304 635 | 0.43 | 1.72 | 8 | 07 | 31 |
| | 2 | 2 | 46 | 00.95 | 15 | 36 | 08.1 | 20.290 643 | 0.43 | 1.73 | 8 | 03 | 44 |
| | 3 | 2 | 46 | 09.76 | 15 | 36 | 47.2 | 20.276 499 | 0.43 | 1.73 | 7 | 59 | 57 |
| | 4 | 2 | 46 | 18.42 | 15 | 37 | 25.6 | 20.262 207 | 0.43 | 1.73 | 7 | 56 | 09 |
| | 5 | 2 | 46 | 26.93 | 15 | 38 | 03.3 | 20.247 770 | 0.43 | 1.73 | 7 | 52 | 22 |
| | 6 | 2 | 46 | 35.30 | 15 | 38 | 40.3 | 20.233 193 | 0.43 | 1.73 | 7 | 48 | 34 |
| | 7 | 2 | 46 | 43.51 | +15 | 39 | 16.5 | 20.218 479 | 0.43 | 1.73 | 7 | 44 | 46 |
| | 8 | 2 | 46 | 51.57 | 15 | 39 | 52.0 | 20.203 631 | 0.44 | 1.73 | 7 | 40 | 58 |
| | 9 | 2 | 46 | 59.46 | 15 | 40 | 26.9 | 20.188 654 | 0.44 | 1.73 | 7 | 37 | 10 |
| | 10 | 2 | 47 | 07.20 | 15 | 41 | 00.9 | 20.173 551 | 0.44 | 1.74 | 7 | 33 | 22 |
| | 11 | 2 | 47 | 14.78 | 15 | 41 | 34.2 | 20.158 328 | 0.44 | 1.74 | 7 | 29 | 34 |
| | 12 | 2 | 47 | 22.19 | 15 | 42 | 06.8 | 20.142 987 | 0.44 | 1.74 | 7 | 25 | 45 |
| | 13 | 2 | 47 | 29.43 | +15 | 42 | 38.6 | 20.127 533 | 0.44 | 1.74 | 7 | 21 | 56 |
| | 14 | 2 | 47 | 36.50 | 15 | 43 | 09.5 | 20.111 971 | 0.44 | 1.74 | 7 | 18 | 07 |
| | 15 | 2 | 47 | 43.40 | 15 | 43 | 39.7 | 20.096 304 | 0.44 | 1.74 | 7 | 14 | 18 |
| | 16 | 2 | 47 | 50.12 | 15 | 44 | 09.1 | 20.080 538 | 0.44 | 1.74 | 7 | 10 | 29 |
| | 17 | 2 | 47 | 56.68 | 15 | 44 | 37.7 | 20.064 677 | 0.44 | 1.75 | 7 | 06 | 40 |
| | 18 | 2 | 48 | 03.06 | 15 | 45 | 05.4 | 20.048 724 | 0.44 | 1.75 | 7 | 02 | 50 |
| | 19 | 2 | 48 | 09.28 | +15 | 45 | 32.4 | 20.032 684 | 0.44 | 1.75 | 6 | 59 | 00 |
| | 20 | 2 | 48 | 15.32 | 15 | 45 | 58.6 | 20.016 562 | 0.44 | 1.75 | 6 | 55 | 10 |
| | 21 | 2 | 48 | 21.19 | 15 | 46 | 23.9 | 20.000 361 | 0.44 | 1.75 | 6 | 51 | 20 |
| | 22 | 2 | 48 | 26.89 | 15 | 46 | 48.6 | 19.984 086 | 0.44 | 1.75 | 6 | 47 | 30 |
| | 23 | 2 | 48 | 32.41 | 15 | 47 | 12.4 | 19.967 740 | 0.44 | 1.75 | 6 | 43 | 39 |
| | 24 | 2 | 48 | 37.74 | 15 | 47 | 35.4 | 19.951 328 | 0.44 | 1.76 | 6 | 39 | 49 |
| | 25 | 2 | 48 | 42.89 | +15 | 47 | 57.6 | 19.934 853 | 0.44 | 1.76 | 6 | 35 | 58 |
| | 26 | 2 | 48 | 47.86 | 15 | 48 | 18.9 | 19.918 319 | 0.44 | 1.76 | 6 | 32 | 07 |
| | 27 | 2 | 48 | 52.63 | 15 | 48 | 39.4 | 19.901 730 | 0.44 | 1.76 | 6 | 28 | 16 |
| | 28 | 2 | 48 | 57.22 | 15 | 48 | 59.1 | 19.885 091 | 0.44 | 1.76 | 6 | 24 | 24 |
| | 29 | 2 | 49 | 01.63 | 15 | 49 | 17.8 | 19.868 405 | 0.44 | 1.76 | 6 | 20 | 33 |
| | 30 | 2 | 49 | 05.84 | 15 | 49 | 35.8 | 19.851 677 | 0.44 | 1.76 | 6 | 16 | 41 |
| | 31 | 2 | 49 | 09.87 | +15 | 49 | 52.9 | 19.834 910 | 0.44 | 1.77 | 6 | 12 | 49 |
| Aug. | 1 | 2 | 49 | 13.72 | 15 | 50 | 09.1 | 19.818 110 | 0.44 | 1.77 | 6 | 08 | 57 |
| | 2 | 2 | 49 | 17.37 | 15 | 50 | 24.5 | 19.801 281 | 0.44 | 1.77 | 6 | 05 | 04 |
| | 3 | 2 | 49 | 20.84 | 15 | 50 | 39.0 | 19.784 427 | 0.44 | 1.77 | 6 | 01 | 12 |
| | 4 | 2 | 49 | 24.12 | 15 | 50 | 52.7 | 19.767 554 | 0.44 | 1.77 | 5 | 57 | 19 |
| | 5 | 2 | 49 | 27.20 | 15 | 51 | 05.6 | 19.750 665 | 0.45 | 1.77 | 5 | 53 | 26 |
| | 6 | 2 | 49 | 30.09 | +15 | 51 | 17.6 | 19.733 765 | 0.45 | 1.77 | 5 | 49 | 33 |
| | 7 | 2 | 49 | 32.78 | 15 | 51 | 28.7 | 19.716 861 | 0.45 | 1.78 | 5 | 45 | 40 |
| | 8 | 2 | 49 | 35.28 | 15 | 51 | 39.0 | 19.699 956 | 0.45 | 1.78 | 5 | 41 | 46 |
| | 9 | 2 | 49 | 37.58 | 15 | 51 | 48.4 | 19.683 055 | 0.45 | 1.78 | 5 | 37 | 53 |
| | 10 | 2 | 49 | 39.67 | 15 | 51 | 56.9 | 19.666 163 | 0.45 | 1.78 | 5 | 33 | 59 |
| | 11 | 2 | 49 | 41.57 | 15 | 52 | 04.5 | 19.649 287 | 0.45 | 1.78 | 5 | 30 | 05 |
| | 12 | 2 | 49 | 43.27 | +15 | 52 | 11.2 | 19.632 429 | 0.45 | 1.78 | 5 | 26 | 11 |
| | 13 | 2 | 49 | 44.76 | 15 | 52 | 17.0 | 19.615 597 | 0.45 | 1.79 | 5 | 22 | 16 |
| | 14 | 2 | 49 | 46.07 | 15 | 52 | 21.9 | 19.598 794 | 0.45 | 1.79 | 5 | 18 | 21 |
| | 15 | 2 | 49 | 47.17 | 15 | 52 | 25.9 | 19.582 026 | 0.45 | 1.79 | 5 | 14 | 27 |
| | 16 | 2 | 49 | 48.09 | +15 | 52 | 29.1 | 19.565 297 | 0.45 | 1.79 | 5 | 10 | 32 |

**URANUS, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Aug. | 16 | 2 | 49 | 48.09 | +15 | 52 | 29.1 | 19.565 297 | 0.45 | 1.79 | 5 | 10 | 32 |
| | 17 | 2 | 49 | 48.81 | 15 | 52 | 31.4 | 19.548 612 | 0.45 | 1.79 | 5 | 06 | 36 |
| | 18 | 2 | 49 | 49.33 | 15 | 52 | 32.9 | 19.531 976 | 0.45 | 1.79 | 5 | 02 | 41 |
| | 19 | 2 | 49 | 49.66 | 15 | 52 | 33.5 | 19.515 393 | 0.45 | 1.79 | 4 | 58 | 45 |
| | 20 | 2 | 49 | 49.79 | 15 | 52 | 33.3 | 19.498 868 | 0.45 | 1.80 | 4 | 54 | 49 |
| | 21 | 2 | 49 | 49.72 | 15 | 52 | 32.2 | 19.482 404 | 0.45 | 1.80 | 4 | 50 | 53 |
| | 22 | 2 | 49 | 49.45 | +15 | 52 | 30.2 | 19.466 007 | 0.45 | 1.80 | 4 | 46 | 57 |
| | 23 | 2 | 49 | 48.98 | 15 | 52 | 27.3 | 19.449 681 | 0.45 | 1.80 | 4 | 43 | 01 |
| | 24 | 2 | 49 | 48.31 | 15 | 52 | 23.6 | 19.433 430 | 0.45 | 1.80 | 4 | 39 | 04 |
| | 25 | 2 | 49 | 47.44 | 15 | 52 | 18.9 | 19.417 258 | 0.45 | 1.80 | 4 | 35 | 07 |
| | 26 | 2 | 49 | 46.37 | 15 | 52 | 13.4 | 19.401 171 | 0.45 | 1.81 | 4 | 31 | 10 |
| | 27 | 2 | 49 | 45.12 | 15 | 52 | 07.0 | 19.385 172 | 0.45 | 1.81 | 4 | 27 | 13 |
| | 28 | 2 | 49 | 43.66 | +15 | 51 | 59.8 | 19.369 266 | 0.45 | 1.81 | 4 | 23 | 16 |
| | 29 | 2 | 49 | 42.02 | 15 | 51 | 51.7 | 19.353 458 | 0.45 | 1.81 | 4 | 19 | 18 |
| | 30 | 2 | 49 | 40.19 | 15 | 51 | 42.8 | 19.337 753 | 0.45 | 1.81 | 4 | 15 | 20 |
| | 31 | 2 | 49 | 38.16 | 15 | 51 | 33.0 | 19.322 155 | 0.46 | 1.81 | 4 | 11 | 23 |
| Sept. | 1 | 2 | 49 | 35.94 | 15 | 51 | 22.4 | 19.306 669 | 0.46 | 1.81 | 4 | 07 | 24 |
| | 2 | 2 | 49 | 33.53 | 15 | 51 | 11.0 | 19.291 301 | 0.46 | 1.82 | 4 | 03 | 26 |
| | 3 | 2 | 49 | 30.93 | +15 | 50 | 58.8 | 19.276 054 | 0.46 | 1.82 | 3 | 59 | 27 |
| | 4 | 2 | 49 | 28.14 | 15 | 50 | 45.7 | 19.260 935 | 0.46 | 1.82 | 3 | 55 | 29 |
| | 5 | 2 | 49 | 25.15 | 15 | 50 | 31.7 | 19.245 947 | 0.46 | 1.82 | 3 | 51 | 30 |
| | 6 | 2 | 49 | 21.97 | 15 | 50 | 16.9 | 19.231 097 | 0.46 | 1.82 | 3 | 47 | 31 |
| | 7 | 2 | 49 | 18.60 | 15 | 50 | 01.3 | 19.216 388 | 0.46 | 1.82 | 3 | 43 | 31 |
| | 8 | 2 | 49 | 15.04 | 15 | 49 | 44.8 | 19.201 825 | 0.46 | 1.82 | 3 | 39 | 32 |
| | 9 | 2 | 49 | 11.30 | +15 | 49 | 27.5 | 19.187 415 | 0.46 | 1.83 | 3 | 35 | 32 |
| | 10 | 2 | 49 | 07.38 | 15 | 49 | 09.4 | 19.173 161 | 0.46 | 1.83 | 3 | 31 | 33 |
| | 11 | 2 | 49 | 03.28 | 15 | 48 | 50.5 | 19.159 068 | 0.46 | 1.83 | 3 | 27 | 33 |
| | 12 | 2 | 48 | 59.00 | 15 | 48 | 30.8 | 19.145 141 | 0.46 | 1.83 | 3 | 23 | 32 |
| | 13 | 2 | 48 | 54.55 | 15 | 48 | 10.3 | 19.131 383 | 0.46 | 1.83 | 3 | 19 | 32 |
| | 14 | 2 | 48 | 49.93 | 15 | 47 | 49.1 | 19.117 800 | 0.46 | 1.83 | 3 | 15 | 31 |
| | 15 | 2 | 48 | 45.13 | +15 | 47 | 27.2 | 19.104 396 | 0.46 | 1.83 | 3 | 11 | 31 |
| | 16 | 2 | 48 | 40.17 | 15 | 47 | 04.5 | 19.091 173 | 0.46 | 1.83 | 3 | 07 | 30 |
| | 17 | 2 | 48 | 35.03 | 15 | 46 | 41.0 | 19.078 137 | 0.46 | 1.84 | 3 | 03 | 29 |
| | 18 | 2 | 48 | 29.72 | 15 | 46 | 16.8 | 19.065 292 | 0.46 | 1.84 | 2 | 59 | 28 |
| | 19 | 2 | 48 | 24.24 | 15 | 45 | 51.9 | 19.052 639 | 0.46 | 1.84 | 2 | 55 | 26 |
| | 20 | 2 | 48 | 18.60 | 15 | 45 | 26.2 | 19.040 185 | 0.46 | 1.84 | 2 | 51 | 25 |
| | 21 | 2 | 48 | 12.79 | +15 | 44 | 59.8 | 19.027 932 | 0.46 | 1.84 | 2 | 47 | 23 |
| | 22 | 2 | 48 | 06.82 | 15 | 44 | 32.7 | 19.015 884 | 0.46 | 1.84 | 2 | 43 | 21 |
| | 23 | 2 | 48 | 00.70 | 15 | 44 | 04.9 | 19.004 044 | 0.46 | 1.84 | 2 | 39 | 19 |
| | 24 | 2 | 47 | 54.43 | 15 | 43 | 36.3 | 18.992 418 | 0.46 | 1.84 | 2 | 35 | 17 |
| | 25 | 2 | 47 | 48.01 | 15 | 43 | 07.1 | 18.981 007 | 0.46 | 1.85 | 2 | 31 | 15 |
| | 26 | 2 | 47 | 41.43 | 15 | 42 | 37.3 | 18.969 817 | 0.46 | 1.85 | 2 | 27 | 12 |
| | 27 | 2 | 47 | 34.72 | +15 | 42 | 06.8 | 18.958 851 | 0.46 | 1.85 | 2 | 23 | 10 |
| | 28 | 2 | 47 | 27.86 | 15 | 41 | 35.7 | 18.948 113 | 0.46 | 1.85 | 2 | 19 | 07 |
| | 29 | 2 | 47 | 20.86 | 15 | 41 | 04.0 | 18.937 607 | 0.46 | 1.85 | 2 | 15 | 04 |
| | 30 | 2 | 47 | 13.72 | 15 | 40 | 31.6 | 18.927 336 | 0.46 | 1.85 | 2 | 11 | 01 |
| Oct. | 1 | 2 | 47 | 06.44 | +15 | 39 | 58.7 | 18.917 305 | 0.46 | 1.85 | 2 | 06 | 58 |

**URANUS, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Oct. | 1 | 2 | 47 | 06.44 | +15 | 39 | 58.7 | 18.917 305 | 0.46 | 1.85 | 2 | 06 | 58 |
| | 2 | 2 | 46 | 59.03 | 15 | 39 | 25.1 | 18.907 516 | 0.47 | 1.85 | 2 | 02 | 54 |
| | 3 | 2 | 46 | 51.48 | 15 | 38 | 51.0 | 18.897 974 | 0.47 | 1.85 | 1 | 58 | 51 |
| | 4 | 2 | 46 | 43.80 | 15 | 38 | 16.2 | 18.888 682 | 0.47 | 1.85 | 1 | 54 | 48 |
| | 5 | 2 | 46 | 36.00 | 15 | 37 | 40.9 | 18.879 645 | 0.47 | 1.85 | 1 | 50 | 44 |
| | 6 | 2 | 46 | 28.07 | 15 | 37 | 05.0 | 18.870 865 | 0.47 | 1.86 | 1 | 46 | 40 |
| | 7 | 2 | 46 | 20.02 | +15 | 36 | 28.6 | 18.862 345 | 0.47 | 1.86 | 1 | 42 | 36 |
| | 8 | 2 | 46 | 11.86 | 15 | 35 | 51.6 | 18.854 090 | 0.47 | 1.86 | 1 | 38 | 32 |
| | 9 | 2 | 46 | 03.60 | 15 | 35 | 14.1 | 18.846 103 | 0.47 | 1.86 | 1 | 34 | 28 |
| | 10 | 2 | 45 | 55.23 | 15 | 34 | 36.2 | 18.838 385 | 0.47 | 1.86 | 1 | 30 | 24 |
| | 11 | 2 | 45 | 46.76 | 15 | 33 | 57.8 | 18.830 940 | 0.47 | 1.86 | 1 | 26 | 19 |
| | 12 | 2 | 45 | 38.20 | 15 | 33 | 19.0 | 18.823 771 | 0.47 | 1.86 | 1 | 22 | 15 |
| | 13 | 2 | 45 | 29.54 | +15 | 32 | 39.8 | 18.816 879 | 0.47 | 1.86 | 1 | 18 | 10 |
| | 14 | 2 | 45 | 20.78 | 15 | 32 | 00.2 | 18.810 266 | 0.47 | 1.86 | 1 | 14 | 06 |
| | 15 | 2 | 45 | 11.93 | 15 | 31 | 20.2 | 18.803 935 | 0.47 | 1.86 | 1 | 10 | 01 |
| | 16 | 2 | 45 | 03.00 | 15 | 30 | 39.7 | 18.797 888 | 0.47 | 1.86 | 1 | 05 | 56 |
| | 17 | 2 | 44 | 53.98 | 15 | 29 | 58.9 | 18.792 126 | 0.47 | 1.86 | 1 | 01 | 51 |
| | 18 | 2 | 44 | 44.88 | 15 | 29 | 17.7 | 18.786 651 | 0.47 | 1.86 | 0 | 57 | 46 |
| | 19 | 2 | 44 | 35.71 | +15 | 28 | 36.2 | 18.781 466 | 0.47 | 1.86 | 0 | 53 | 41 |
| | 20 | 2 | 44 | 26.46 | 15 | 27 | 54.3 | 18.776 571 | 0.47 | 1.87 | 0 | 49 | 36 |
| | 21 | 2 | 44 | 17.16 | 15 | 27 | 12.1 | 18.771 969 | 0.47 | 1.87 | 0 | 45 | 31 |
| | 22 | 2 | 44 | 07.79 | 15 | 26 | 29.7 | 18.767 661 | 0.47 | 1.87 | 0 | 41 | 26 |
| | 23 | 2 | 43 | 58.37 | 15 | 25 | 47.0 | 18.763 648 | 0.47 | 1.87 | 0 | 37 | 21 |
| | 24 | 2 | 43 | 48.90 | 15 | 25 | 04.0 | 18.759 934 | 0.47 | 1.87 | 0 | 33 | 15 |
| | 25 | 2 | 43 | 39.38 | +15 | 24 | 20.8 | 18.756 518 | 0.47 | 1.87 | 0 | 29 | 10 |
| | 26 | 2 | 43 | 29.81 | 15 | 23 | 37.4 | 18.753 403 | 0.47 | 1.87 | 0 | 25 | 05 |
| | 27 | 2 | 43 | 20.20 | 15 | 22 | 53.9 | 18.750 590 | 0.47 | 1.87 | 0 | 20 | 59 |
| | 28 | 2 | 43 | 10.55 | 15 | 22 | 10.1 | 18.748 080 | 0.47 | 1.87 | 0 | 16 | 54 |
| | 29 | 2 | 43 | 00.86 | 15 | 21 | 26.2 | 18.745 875 | 0.47 | 1.87 | 0 | 12 | 48 |
| | 30 | 2 | 42 | 51.14 | 15 | 20 | 42.2 | 18.743 976 | 0.47 | 1.87 | 0 | 08 | 42 |
| | 31 | 2 | 42 | 41.40 | +15 | 19 | 57.9 | 18.742 385 | 0.47 | 1.87 | 0 | 04 | 37 |
| Nov. | 1 | 2 | 42 | 31.62 | 15 | 19 | 13.6 | 18.741 102 | 0.47 | 1.87 | 0 | 00 | 31 |
| | 2 | 2 | 42 | 21.83 | 15 | 18 | 29.2 | 18.740 128 | 0.47 | 1.87 | 23 | 52 | 20 |
| | 3 | 2 | 42 | 12.02 | 15 | 17 | 44.7 | 18.739 464 | 0.47 | 1.87 | 23 | 48 | 14 |
| | 4 | 2 | 42 | 02.21 | 15 | 17 | 00.1 | 18.739 112 | 0.47 | 1.87 | 23 | 44 | 09 |
| | 5 | 2 | 41 | 52.40 | 15 | 16 | 15.5 | 18.739 071 | 0.47 | 1.87 | 23 | 40 | 03 |
| | 6 | 2 | 41 | 42.59 | +15 | 15 | 30.9 | 18.739 342 | 0.47 | 1.87 | 23 | 35 | 57 |
| | 7 | 2 | 41 | 32.79 | 15 | 14 | 46.3 | 18.739 925 | 0.47 | 1.87 | 23 | 31 | 52 |
| | 8 | 2 | 41 | 23.01 | 15 | 14 | 01.8 | 18.740 819 | 0.47 | 1.87 | 23 | 27 | 46 |
| | 9 | 2 | 41 | 13.24 | 15 | 13 | 17.4 | 18.742 025 | 0.47 | 1.87 | 23 | 23 | 40 |
| | 10 | 2 | 41 | 03.48 | 15 | 12 | 33.1 | 18.743 541 | 0.47 | 1.87 | 23 | 19 | 35 |
| | 11 | 2 | 40 | 53.74 | 15 | 11 | 48.9 | 18.745 366 | 0.47 | 1.87 | 23 | 15 | 29 |
| | 12 | 2 | 40 | 44.03 | +15 | 11 | 04.8 | 18.747 501 | 0.47 | 1.87 | 23 | 11 | 24 |
| | 13 | 2 | 40 | 34.35 | 15 | 10 | 20.8 | 18.749 944 | 0.47 | 1.87 | 23 | 07 | 18 |
| | 14 | 2 | 40 | 24.70 | 15 | 09 | 37.0 | 18.752 693 | 0.47 | 1.87 | 23 | 03 | 13 |
| | 15 | 2 | 40 | 15.08 | 15 | 08 | 53.3 | 18.755 748 | 0.47 | 1.87 | 22 | 59 | 07 |
| | 16 | 2 | 40 | 05.52 | +15 | 08 | 09.8 | 18.759 108 | 0.47 | 1.87 | 22 | 55 | 02 |

**URANUS, 2021**
RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Nov. | 16 | 2 | 40 | 05.52 | +15 | 08 | 09.8 | 18.759 108 | 0.47 | 1.87 | 22 | 55 | 02 |
| | 17 | 2 | 39 | 56.00 | 15 | 07 | 26.5 | 18.762 772 | 0.47 | 1.87 | 22 | 50 | 57 |
| | 18 | 2 | 39 | 46.53 | 15 | 06 | 43.5 | 18.766 738 | 0.47 | 1.87 | 22 | 46 | 51 |
| | 19 | 2 | 39 | 37.13 | 15 | 06 | 00.7 | 18.771 005 | 0.47 | 1.87 | 22 | 42 | 46 |
| | 20 | 2 | 39 | 27.79 | 15 | 05 | 18.2 | 18.775 571 | 0.47 | 1.87 | 22 | 38 | 41 |
| | 21 | 2 | 39 | 18.51 | 15 | 04 | 36.0 | 18.780 436 | 0.47 | 1.86 | 22 | 34 | 36 |
| | 22 | 2 | 39 | 09.30 | +15 | 03 | 54.1 | 18.785 598 | 0.47 | 1.86 | 22 | 30 | 31 |
| | 23 | 2 | 39 | 00.16 | 15 | 03 | 12.6 | 18.791 056 | 0.47 | 1.86 | 22 | 26 | 26 |
| | 24 | 2 | 38 | 51.10 | 15 | 02 | 31.4 | 18.796 808 | 0.47 | 1.86 | 22 | 22 | 21 |
| | 25 | 2 | 38 | 42.12 | 15 | 01 | 50.6 | 18.802 852 | 0.47 | 1.86 | 22 | 18 | 16 |
| | 26 | 2 | 38 | 33.21 | 15 | 01 | 10.2 | 18.809 187 | 0.47 | 1.86 | 22 | 14 | 12 |
| | 27 | 2 | 38 | 24.39 | 15 | 00 | 30.2 | 18.815 811 | 0.47 | 1.86 | 22 | 10 | 07 |
| | 28 | 2 | 38 | 15.66 | +14 | 59 | 50.6 | 18.822 722 | 0.47 | 1.86 | 22 | 06 | 03 |
| | 29 | 2 | 38 | 07.03 | 14 | 59 | 11.4 | 18.829 918 | 0.47 | 1.86 | 22 | 01 | 58 |
| | 30 | 2 | 37 | 58.49 | 14 | 58 | 32.6 | 18.837 398 | 0.47 | 1.86 | 21 | 57 | 54 |
| Dec. | 1 | 2 | 37 | 50.05 | 14 | 57 | 54.3 | 18.845 158 | 0.47 | 1.86 | 21 | 53 | 50 |
| | 2 | 2 | 37 | 41.73 | 14 | 57 | 16.5 | 18.853 197 | 0.47 | 1.86 | 21 | 49 | 46 |
| | 3 | 2 | 37 | 33.51 | 14 | 56 | 39.2 | 18.861 512 | 0.47 | 1.86 | 21 | 45 | 42 |
| | 4 | 2 | 37 | 25.42 | +14 | 56 | 02.5 | 18.870 100 | 0.47 | 1.86 | 21 | 41 | 38 |
| | 5 | 2 | 37 | 17.45 | 14 | 55 | 26.4 | 18.878 959 | 0.47 | 1.85 | 21 | 37 | 34 |
| | 6 | 2 | 37 | 09.61 | 14 | 54 | 50.9 | 18.888 085 | 0.47 | 1.85 | 21 | 33 | 30 |
| | 7 | 2 | 37 | 01.89 | 14 | 54 | 16.0 | 18.897 474 | 0.47 | 1.85 | 21 | 29 | 27 |
| | 8 | 2 | 36 | 54.29 | 14 | 53 | 41.7 | 18.907 123 | 0.47 | 1.85 | 21 | 25 | 24 |
| | 9 | 2 | 36 | 46.83 | 14 | 53 | 08.0 | 18.917 028 | 0.46 | 1.85 | 21 | 21 | 20 |
| | 10 | 2 | 36 | 39.49 | +14 | 52 | 34.9 | 18.927 186 | 0.46 | 1.85 | 21 | 17 | 17 |
| | 11 | 2 | 36 | 32.29 | 14 | 52 | 02.5 | 18.937 592 | 0.46 | 1.85 | 21 | 13 | 14 |
| | 12 | 2 | 36 | 25.24 | 14 | 51 | 30.7 | 18.948 243 | 0.46 | 1.85 | 21 | 09 | 11 |
| | 13 | 2 | 36 | 18.32 | 14 | 50 | 59.6 | 18.959 135 | 0.46 | 1.85 | 21 | 05 | 09 |
| | 14 | 2 | 36 | 11.56 | 14 | 50 | 29.1 | 18.970 264 | 0.46 | 1.85 | 21 | 01 | 06 |
| | 15 | 2 | 36 | 04.95 | 14 | 49 | 59.4 | 18.981 627 | 0.46 | 1.84 | 20 | 57 | 04 |
| | 16 | 2 | 35 | 58.49 | +14 | 49 | 30.4 | 18.993 219 | 0.46 | 1.84 | 20 | 53 | 02 |
| | 17 | 2 | 35 | 52.20 | 14 | 49 | 02.2 | 19.005 037 | 0.46 | 1.84 | 20 | 48 | 60 |
| | 18 | 2 | 35 | 46.06 | 14 | 48 | 34.7 | 19.017 076 | 0.46 | 1.84 | 20 | 44 | 58 |
| | 19 | 2 | 35 | 40.09 | 14 | 48 | 08.1 | 19.029 333 | 0.46 | 1.84 | 20 | 40 | 56 |
| | 20 | 2 | 35 | 34.27 | 14 | 47 | 42.2 | 19.041 803 | 0.46 | 1.84 | 20 | 36 | 55 |
| | 21 | 2 | 35 | 28.63 | 14 | 47 | 17.1 | 19.054 484 | 0.46 | 1.84 | 20 | 32 | 53 |
| | 22 | 2 | 35 | 23.15 | +14 | 46 | 52.8 | 19.067 370 | 0.46 | 1.84 | 20 | 28 | 52 |
| | 23 | 2 | 35 | 17.84 | 14 | 46 | 29.3 | 19.080 458 | 0.46 | 1.84 | 20 | 24 | 51 |
| | 24 | 2 | 35 | 12.70 | 14 | 46 | 06.6 | 19.093 744 | 0.46 | 1.83 | 20 | 20 | 50 |
| | 25 | 2 | 35 | 07.73 | 14 | 45 | 44.7 | 19.107 223 | 0.46 | 1.83 | 20 | 16 | 49 |
| | 26 | 2 | 35 | 02.93 | 14 | 45 | 23.7 | 19.120 891 | 0.46 | 1.83 | 20 | 12 | 49 |
| | 27 | 2 | 34 | 58.32 | 14 | 45 | 03.5 | 19.134 745 | 0.46 | 1.83 | 20 | 08 | 48 |
| | 28 | 2 | 34 | 53.88 | +14 | 44 | 44.1 | 19.148 780 | 0.46 | 1.83 | 20 | 04 | 48 |
| | 29 | 2 | 34 | 49.63 | 14 | 44 | 25.6 | 19.162 990 | 0.46 | 1.83 | 20 | 00 | 48 |
| | 30 | 2 | 34 | 45.57 | 14 | 44 | 08.0 | 19.177 373 | 0.46 | 1.83 | 19 | 56 | 49 |
| | 31 | 2 | 34 | 41.70 | 14 | 43 | 51.3 | 19.191 922 | 0.46 | 1.82 | 19 | 52 | 49 |
| | 32 | 2 | 34 | 38.03 | +14 | 43 | 35.6 | 19.206 634 | 0.46 | 1.82 | 19 | 48 | 50 |

**NEPTUNE, 2021**

HELIOCENTRIC POSITIONS FOR $0^h$ TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

| Date | | Heliocentric Longitude ° ′ ″ | Heliocentric Latitude ° ′ ″ | Radius Vector | Date | | Heliocentric Longitude ° ′ ″ | Heliocentric Latitude ° ′ ″ | Radius Vector |
|---|---|---|---|---|---|---|---|---|---|
| Jan. | 1 | 350 13 24.1 | -1 05 38.5 | 29.926 96 | Apr. | 3 | 350 47 01.7 | -1 06 26.9 | 29.925 37 |
| | 3 | 350 14 08.0 | 1 05 39.5 | 29.926 93 | | 5 | 350 47 45.5 | 1 06 27.9 | 29.925 33 |
| | 5 | 350 14 51.8 | 1 05 40.6 | 29.926 89 | | 7 | 350 48 29.4 | 1 06 29.0 | 29.925 30 |
| | 7 | 350 15 35.7 | 1 05 41.6 | 29.926 86 | | 9 | 350 49 13.3 | 1 06 30.0 | 29.925 26 |
| | 9 | 350 16 19.5 | 1 05 42.7 | 29.926 82 | | 11 | 350 49 57.1 | 1 06 31.1 | 29.925 23 |
| | 11 | 350 17 03.4 | 1 05 43.8 | 29.926 79 | | 13 | 350 50 41.0 | 1 06 32.1 | 29.925 19 |
| | 13 | 350 17 47.2 | -1 05 44.8 | 29.926 75 | | 15 | 350 51 24.9 | -1 06 33.1 | 29.925 16 |
| | 15 | 350 18 31.1 | 1 05 45.9 | 29.926 72 | | 17 | 350 52 08.7 | 1 06 34.2 | 29.925 12 |
| | 17 | 350 19 14.9 | 1 05 46.9 | 29.926 69 | | 19 | 350 52 52.6 | 1 06 35.3 | 29.925 08 |
| | 19 | 350 19 58.8 | 1 05 48.0 | 29.926 65 | | 21 | 350 53 36.5 | 1 06 36.3 | 29.925 05 |
| | 21 | 350 20 42.6 | 1 05 49.0 | 29.926 62 | | 23 | 350 54 20.4 | 1 06 37.3 | 29.925 01 |
| | 23 | 350 21 26.5 | 1 05 50.1 | 29.926 58 | | 25 | 350 55 04.2 | 1 06 38.4 | 29.924 98 |
| | 25 | 350 22 10.3 | -1 05 51.1 | 29.926 55 | | 27 | 350 55 48.1 | -1 06 39.4 | 29.924 94 |
| | 27 | 350 22 54.2 | 1 05 52.2 | 29.926 51 | | 29 | 350 56 32.0 | 1 06 40.5 | 29.924 91 |
| | 29 | 350 23 38.1 | 1 05 53.3 | 29.926 48 | May | 1 | 350 57 15.8 | 1 06 41.5 | 29.924 87 |
| | 31 | 350 24 21.9 | 1 05 54.3 | 29.926 45 | | 3 | 350 57 59.7 | 1 06 42.6 | 29.924 84 |
| Feb. | 2 | 350 25 05.8 | 1 05 55.3 | 29.926 41 | | 5 | 350 58 43.6 | 1 06 43.6 | 29.924 80 |
| | 4 | 350 25 49.6 | 1 05 56.4 | 29.926 38 | | 7 | 350 59 27.5 | 1 06 44.6 | 29.924 76 |
| | 6 | 350 26 33.5 | -1 05 57.5 | 29.926 34 | | 9 | 351 00 11.3 | -1 06 45.7 | 29.924 73 |
| | 8 | 350 27 17.4 | 1 05 58.5 | 29.926 31 | | 11 | 351 00 55.2 | 1 06 46.8 | 29.924 69 |
| | 10 | 350 28 01.2 | 1 05 59.5 | 29.926 27 | | 13 | 351 01 39.1 | 1 06 47.8 | 29.924 66 |
| | 12 | 350 28 45.1 | 1 06 00.6 | 29.926 24 | | 15 | 351 02 22.9 | 1 06 48.8 | 29.924 62 |
| | 14 | 350 29 28.9 | 1 06 01.7 | 29.926 20 | | 17 | 351 03 06.8 | 1 06 49.9 | 29.924 59 |
| | 16 | 350 30 12.8 | 1 06 02.7 | 29.926 17 | | 19 | 351 03 50.7 | 1 06 50.9 | 29.924 55 |
| | 18 | 350 30 56.6 | -1 06 03.8 | 29.926 13 | | 21 | 351 04 34.6 | -1 06 52.0 | 29.924 51 |
| | 20 | 350 31 40.5 | 1 06 04.8 | 29.926 10 | | 23 | 351 05 18.4 | 1 06 53.0 | 29.924 48 |
| | 22 | 350 32 24.4 | 1 06 05.9 | 29.926 07 | | 25 | 351 06 02.3 | 1 06 54.1 | 29.924 44 |
| | 24 | 350 33 08.2 | 1 06 06.9 | 29.926 03 | | 27 | 351 06 46.2 | 1 06 55.1 | 29.924 41 |
| | 26 | 350 33 52.1 | 1 06 08.0 | 29.926 00 | | 29 | 351 07 30.0 | 1 06 56.1 | 29.924 37 |
| | 28 | 350 34 36.0 | 1 06 09.0 | 29.925 96 | | 31 | 351 08 14.0 | 1 06 57.2 | 29.924 34 |
| Mar. | 2 | 350 35 19.8 | -1 06 10.1 | 29.925 93 | June | 2 | 351 08 57.8 | -1 06 58.2 | 29.924 30 |
| | 4 | 350 36 03.7 | 1 06 11.1 | 29.925 89 | | 4 | 351 09 41.7 | 1 06 59.3 | 29.924 26 |
| | 6 | 350 36 47.5 | 1 06 12.2 | 29.925 86 | | 6 | 351 10 25.6 | 1 07 00.3 | 29.924 23 |
| | 8 | 350 37 31.4 | 1 06 13.2 | 29.925 82 | | 8 | 351 11 09.4 | 1 07 01.4 | 29.924 19 |
| | 10 | 350 38 15.3 | 1 06 14.3 | 29.925 79 | | 10 | 351 11 53.3 | 1 07 02.4 | 29.924 16 |
| | 12 | 350 38 59.1 | 1 06 15.3 | 29.925 75 | | 12 | 351 12 37.2 | 1 07 03.4 | 29.924 12 |
| | 14 | 350 39 43.0 | -1 06 16.4 | 29.925 72 | | 14 | 351 13 21.1 | -1 07 04.5 | 29.924 08 |
| | 16 | 350 40 26.9 | 1 06 17.4 | 29.925 68 | | 16 | 351 14 05.0 | 1 07 05.5 | 29.924 05 |
| | 18 | 350 41 10.7 | 1 06 18.5 | 29.925 65 | | 18 | 351 14 48.8 | 1 07 06.6 | 29.924 01 |
| | 20 | 350 41 54.6 | 1 06 19.5 | 29.925 61 | | 20 | 351 15 32.7 | 1 07 07.6 | 29.923 97 |
| | 22 | 350 42 38.4 | 1 06 20.6 | 29.925 58 | | 22 | 351 16 16.6 | 1 07 08.6 | 29.923 94 |
| | 24 | 350 43 22.3 | 1 06 21.6 | 29.925 54 | | 24 | 351 17 00.4 | 1 07 09.7 | 29.923 90 |
| | 26 | 350 44 06.2 | -1 06 22.7 | 29.925 51 | | 26 | 351 17 44.4 | -1 07 10.7 | 29.923 87 |
| | 28 | 350 44 50.1 | 1 06 23.7 | 29.925 47 | | 28 | 351 18 28.2 | 1 07 11.8 | 29.923 83 |
| | 30 | 350 45 33.9 | 1 06 24.8 | 29.925 44 | | 30 | 351 19 12.1 | 1 07 12.8 | 29.923 79 |
| Apr. | 1 | 350 46 17.8 | 1 06 25.8 | 29.925 40 | July | 2 | 351 19 56.0 | 1 07 13.9 | 29.923 76 |
| | 3 | 350 47 01.7 | -1 06 26.9 | 29.925 37 | | 4 | 351 20 39.9 | -1 07 14.9 | 29.923 72 |

**NEPTUNE, 2021**

HELIOCENTRIC POSITIONS FOR $0^h$ TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

| Date | | Heliocentric Longitude | Heliocentric Latitude | Radius Vector | Date | | Heliocentric Longitude | Heliocentric Latitude | Radius Vector |
|---|---|---|---|---|---|---|---|---|---|
| | | ° ′ ″ | ° ′ ″ | | | | ° ′ ″ | ° ′ ″ | |
| July | 2 | 351 19 56.0 | -1 07 13.9 | 29.923 76 | Oct. | 2 | 351 53 34.8 | -1 08 01.5 | 29.922 06 |
| | 4 | 351 20 39.9 | 1 07 14.9 | 29.923 72 | | 4 | 351 54 18.7 | 1 08 02.5 | 29.922 02 |
| | 6 | 351 21 23.7 | 1 07 15.9 | 29.923 68 | | 6 | 351 55 02.6 | 1 08 03.5 | 29.921 98 |
| | 8 | 351 22 07.6 | 1 07 17.0 | 29.923 65 | | 8 | 351 55 46.5 | 1 08 04.6 | 29.921 94 |
| | 10 | 351 22 51.5 | 1 07 18.0 | 29.923 61 | | 10 | 351 56 30.3 | 1 08 05.6 | 29.921 90 |
| | 12 | 351 23 35.4 | 1 07 19.0 | 29.923 58 | | 12 | 351 57 14.2 | 1 08 06.7 | 29.921 87 |
| | 14 | 351 24 19.3 | -1 07 20.1 | 29.923 54 | | 14 | 351 57 58.2 | -1 08 07.7 | 29.921 83 |
| | 16 | 351 25 03.1 | 1 07 21.1 | 29.923 50 | | 16 | 351 58 42.0 | 1 08 08.7 | 29.921 79 |
| | 18 | 351 25 47.0 | 1 07 22.2 | 29.923 47 | | 18 | 351 59 25.9 | 1 08 09.8 | 29.921 75 |
| | 20 | 351 26 30.9 | 1 07 23.2 | 29.923 43 | | 20 | 352 00 09.8 | 1 08 10.8 | 29.921 71 |
| | 22 | 351 27 14.8 | 1 07 24.2 | 29.923 39 | | 22 | 352 00 53.7 | 1 08 11.8 | 29.921 68 |
| | 24 | 351 27 58.7 | 1 07 25.3 | 29.923 36 | | 24 | 352 01 37.6 | 1 08 12.9 | 29.921 64 |
| | 26 | 351 28 42.6 | -1 07 26.3 | 29.923 32 | | 26 | 352 02 21.5 | -1 08 13.9 | 29.921 60 |
| | 28 | 351 29 26.4 | 1 07 27.4 | 29.923 28 | | 28 | 352 03 05.4 | 1 08 14.9 | 29.921 56 |
| | 30 | 351 30 10.3 | 1 07 28.4 | 29.923 25 | | 30 | 352 03 49.3 | 1 08 15.9 | 29.921 52 |
| Aug. | 1 | 351 30 54.2 | 1 07 29.4 | 29.923 21 | Nov. | 1 | 352 04 33.2 | 1 08 17.0 | 29.921 49 |
| | 3 | 351 31 38.1 | 1 07 30.5 | 29.923 17 | | 3 | 352 05 17.1 | 1 08 18.0 | 29.921 45 |
| | 5 | 351 32 22.0 | 1 07 31.5 | 29.923 14 | | 5 | 352 06 01.0 | 1 08 19.0 | 29.921 41 |
| | 7 | 351 33 05.9 | -1 07 32.5 | 29.923 10 | | 7 | 352 06 44.9 | -1 08 20.0 | 29.921 37 |
| | 9 | 351 33 49.7 | 1 07 33.6 | 29.923 06 | | 9 | 352 07 28.8 | 1 08 21.1 | 29.921 33 |
| | 11 | 351 34 33.7 | 1 07 34.6 | 29.923 03 | | 11 | 352 08 12.7 | 1 08 22.1 | 29.921 29 |
| | 13 | 351 35 17.5 | 1 07 35.7 | 29.922 99 | | 13 | 352 08 56.6 | 1 08 23.1 | 29.921 25 |
| | 15 | 351 36 01.4 | 1 07 36.7 | 29.922 95 | | 15 | 352 09 40.5 | 1 08 24.2 | 29.921 22 |
| | 17 | 351 36 45.3 | 1 07 37.7 | 29.922 91 | | 17 | 352 10 24.4 | 1 08 25.2 | 29.921 18 |
| | 19 | 351 37 29.2 | -1 07 38.8 | 29.922 88 | | 19 | 352 11 08.3 | -1 08 26.2 | 29.921 14 |
| | 21 | 351 38 13.1 | 1 07 39.8 | 29.922 84 | | 21 | 352 11 52.2 | 1 08 27.2 | 29.921 10 |
| | 23 | 351 38 57.0 | 1 07 40.8 | 29.922 80 | | 23 | 352 12 36.1 | 1 08 28.3 | 29.921 06 |
| | 25 | 351 39 40.9 | 1 07 41.9 | 29.922 77 | | 25 | 352 13 20.0 | 1 08 29.3 | 29.921 02 |
| | 27 | 351 40 24.7 | 1 07 42.9 | 29.922 73 | | 27 | 352 14 03.9 | 1 08 30.3 | 29.920 98 |
| | 29 | 351 41 08.6 | 1 07 43.9 | 29.922 69 | | 29 | 352 14 47.8 | 1 08 31.4 | 29.920 95 |
| | 31 | 351 41 52.5 | -1 07 45.0 | 29.922 66 | Dec. | 1 | 352 15 31.7 | -1 08 32.4 | 29.920 91 |
| Sept. | 2 | 351 42 36.4 | 1 07 46.0 | 29.922 62 | | 3 | 352 16 15.6 | 1 08 33.4 | 29.920 87 |
| | 4 | 351 43 20.3 | 1 07 47.1 | 29.922 58 | | 5 | 352 16 59.5 | 1 08 34.4 | 29.920 83 |
| | 6 | 351 44 04.2 | 1 07 48.1 | 29.922 54 | | 7 | 352 17 43.4 | 1 08 35.5 | 29.920 79 |
| | 8 | 351 44 48.1 | 1 07 49.1 | 29.922 51 | | 9 | 352 18 27.3 | 1 08 36.5 | 29.920 75 |
| | 10 | 351 45 32.0 | 1 07 50.1 | 29.922 47 | | 11 | 352 19 11.2 | 1 08 37.5 | 29.920 71 |
| | 12 | 351 46 15.8 | -1 07 51.2 | 29.922 43 | | 13 | 352 19 55.1 | -1 08 38.5 | 29.920 67 |
| | 14 | 351 46 59.8 | 1 07 52.2 | 29.922 39 | | 15 | 352 20 39.0 | 1 08 39.5 | 29.920 63 |
| | 16 | 351 47 43.6 | 1 07 53.2 | 29.922 36 | | 17 | 352 21 22.9 | 1 08 40.6 | 29.920 59 |
| | 18 | 351 48 27.5 | 1 07 54.3 | 29.922 32 | | 19 | 352 22 06.8 | 1 08 41.6 | 29.920 55 |
| | 20 | 351 49 11.4 | 1 07 55.3 | 29.922 28 | | 21 | 352 22 50.7 | 1 08 42.6 | 29.920 52 |
| | 22 | 351 49 55.3 | 1 07 56.3 | 29.922 24 | | 23 | 352 23 34.6 | 1 08 43.6 | 29.920 48 |
| | 24 | 351 50 39.2 | -1 07 57.4 | 29.922 21 | | 25 | 352 24 18.5 | -1 08 44.7 | 29.920 44 |
| | 26 | 351 51 23.1 | 1 07 58.4 | 29.922 17 | | 27 | 352 25 02.4 | 1 08 45.7 | 29.920 40 |
| | 28 | 351 52 07.0 | 1 07 59.5 | 29.922 13 | | 29 | 352 25 46.3 | 1 08 46.7 | 29.920 36 |
| | 30 | 351 52 50.9 | 1 08 00.5 | 29.922 09 | | 31 | 352 26 30.2 | 1 08 47.7 | 29.920 32 |
| Oct. | 2 | 351 53 34.8 | -1 08 01.5 | 29.922 06 | | 33 | 352 27 14.1 | -1 08 48.8 | 29.920 28 |

**NEPTUNE, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| Jan. | 0 | 348 | 27 | 19 | -1 | 04 | 53.6 | Feb. | 15 | 349 | 44 | 28 | -1 | 04 | 06.0 |
| | 1 | 348 | 28 | 24 | 1 | 04 | 52.0 | | 16 | 349 | 46 | 36 | 1 | 04 | 05.6 |
| | 2 | 348 | 29 | 32 | 1 | 04 | 50.5 | | 17 | 349 | 48 | 45 | 1 | 04 | 05.3 |
| | 3 | 348 | 30 | 41 | 1 | 04 | 49.0 | | 18 | 349 | 50 | 54 | 1 | 04 | 05.0 |
| | 4 | 348 | 31 | 53 | 1 | 04 | 47.4 | | 19 | 349 | 53 | 04 | 1 | 04 | 04.8 |
| | 5 | 348 | 33 | 06 | 1 | 04 | 46.0 | | 20 | 349 | 55 | 15 | 1 | 04 | 04.5 |
| | 6 | 348 | 34 | 20 | -1 | 04 | 44.5 | | 21 | 349 | 57 | 26 | -1 | 04 | 04.4 |
| | 7 | 348 | 35 | 37 | 1 | 04 | 43.0 | | 22 | 349 | 59 | 38 | 1 | 04 | 04.2 |
| | 8 | 348 | 36 | 55 | 1 | 04 | 41.6 | | 23 | 350 | 01 | 51 | 1 | 04 | 04.1 |
| | 9 | 348 | 38 | 15 | 1 | 04 | 40.2 | | 24 | 350 | 04 | 04 | 1 | 04 | 04.0 |
| | 10 | 348 | 39 | 37 | 1 | 04 | 38.8 | | 25 | 350 | 06 | 17 | 1 | 04 | 04.0 |
| | 11 | 348 | 41 | 01 | 1 | 04 | 37.5 | | 26 | 350 | 08 | 31 | 1 | 04 | 03.9 |
| | 12 | 348 | 42 | 26 | -1 | 04 | 36.1 | | 27 | 350 | 10 | 45 | -1 | 04 | 04.0 |
| | 13 | 348 | 43 | 53 | 1 | 04 | 34.8 | | 28 | 350 | 12 | 60 | 1 | 04 | 04.0 |
| | 14 | 348 | 45 | 22 | 1 | 04 | 33.5 | Mar. | 1 | 350 | 15 | 15 | 1 | 04 | 04.1 |
| | 15 | 348 | 46 | 52 | 1 | 04 | 32.2 | | 2 | 350 | 17 | 30 | 1 | 04 | 04.3 |
| | 16 | 348 | 48 | 24 | 1 | 04 | 30.9 | | 3 | 350 | 19 | 45 | 1 | 04 | 04.4 |
| | 17 | 348 | 49 | 57 | 1 | 04 | 29.7 | | 4 | 350 | 22 | 01 | 1 | 04 | 04.6 |
| | 18 | 348 | 51 | 32 | -1 | 04 | 28.5 | | 5 | 350 | 24 | 17 | -1 | 04 | 04.9 |
| | 19 | 348 | 53 | 08 | 1 | 04 | 27.3 | | 6 | 350 | 26 | 33 | 1 | 04 | 05.2 |
| | 20 | 348 | 54 | 46 | 1 | 04 | 26.2 | | 7 | 350 | 28 | 50 | 1 | 04 | 05.5 |
| | 21 | 348 | 56 | 25 | 1 | 04 | 25.0 | | 8 | 350 | 31 | 07 | 1 | 04 | 05.9 |
| | 22 | 348 | 58 | 06 | 1 | 04 | 23.9 | | 9 | 350 | 33 | 23 | 1 | 04 | 06.3 |
| | 23 | 348 | 59 | 48 | 1 | 04 | 22.8 | | 10 | 350 | 35 | 40 | 1 | 04 | 06.8 |
| | 24 | 349 | 01 | 31 | -1 | 04 | 21.8 | | 11 | 350 | 37 | 57 | -1 | 04 | 07.5 |
| | 25 | 349 | 03 | 16 | 1 | 04 | 20.7 | | 12 | 350 | 40 | 13 | 1 | 04 | 07.8 |
| | 26 | 349 | 05 | 03 | 1 | 04 | 19.7 | | 13 | 350 | 42 | 30 | 1 | 04 | 08.2 |
| | 27 | 349 | 06 | 50 | 1 | 04 | 18.7 | | 14 | 350 | 44 | 47 | 1 | 04 | 08.7 |
| | 28 | 349 | 08 | 39 | 1 | 04 | 17.8 | | 15 | 350 | 47 | 03 | 1 | 04 | 09.2 |
| | 29 | 349 | 10 | 29 | 1 | 04 | 16.9 | | 16 | 350 | 49 | 20 | 1 | 04 | 09.9 |
| | 30 | 349 | 12 | 21 | -1 | 04 | 16.0 | | 17 | 350 | 51 | 36 | -1 | 04 | 10.5 |
| | 31 | 349 | 14 | 13 | 1 | 04 | 15.1 | | 18 | 350 | 53 | 52 | 1 | 04 | 11.2 |
| Feb. | 1 | 349 | 16 | 07 | 1 | 04 | 14.3 | | 19 | 350 | 56 | 08 | 1 | 04 | 11.9 |
| | 2 | 349 | 18 | 02 | 1 | 04 | 13.5 | | 20 | 350 | 58 | 24 | 1 | 04 | 12.7 |
| | 3 | 349 | 19 | 58 | 1 | 04 | 12.7 | | 21 | 351 | 00 | 39 | 1 | 04 | 13.5 |
| | 4 | 349 | 21 | 55 | 1 | 04 | 12.0 | | 22 | 351 | 02 | 54 | 1 | 04 | 14.3 |
| | 5 | 349 | 23 | 53 | -1 | 04 | 11.3 | | 23 | 351 | 05 | 09 | -1 | 04 | 15.2 |
| | 6 | 349 | 25 | 52 | 1 | 04 | 10.6 | | 24 | 351 | 07 | 23 | 1 | 04 | 16.1 |
| | 7 | 349 | 27 | 52 | 1 | 04 | 10.0 | | 25 | 351 | 09 | 37 | 1 | 04 | 17.1 |
| | 8 | 349 | 29 | 54 | 1 | 04 | 09.4 | | 26 | 351 | 11 | 51 | 1 | 04 | 18.0 |
| | 9 | 349 | 31 | 56 | 1 | 04 | 08.8 | | 27 | 351 | 14 | 04 | 1 | 04 | 19.1 |
| | 10 | 349 | 33 | 59 | 1 | 04 | 08.2 | | 28 | 351 | 16 | 16 | 1 | 04 | 20.1 |
| | 11 | 349 | 36 | 03 | -1 | 04 | 07.7 | | 29 | 351 | 18 | 28 | -1 | 04 | 21.2 |
| | 12 | 349 | 38 | 08 | 1 | 04 | 07.2 | | 30 | 351 | 20 | 40 | 1 | 04 | 22.3 |
| | 13 | 349 | 40 | 14 | 1 | 04 | 06.8 | | 31 | 351 | 22 | 51 | 1 | 04 | 23.5 |
| | 14 | 349 | 42 | 21 | 1 | 04 | 06.4 | Apr. | 1 | 351 | 25 | 01 | 1 | 04 | 24.7 |
| | 15 | 349 | 44 | 28 | -1 | 04 | 06.0 | | 2 | 351 | 27 | 11 | -1 | 04 | 25.9 |

**NEPTUNE, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| Apr. | 1 | 351 | 25 | 01 | -1 | 04 | 24.7 | May | 17 | 352 | 46 | 39 | -1 | 05 | 51.8 |
| | 2 | 351 | 27 | 11 | 1 | 04 | 25.9 | | 18 | 352 | 47 | 53 | 1 | 05 | 54.2 |
| | 3 | 351 | 29 | 20 | 1 | 04 | 27.1 | | 19 | 352 | 49 | 06 | 1 | 05 | 56.7 |
| | 4 | 351 | 31 | 29 | 1 | 04 | 28.4 | | 20 | 352 | 50 | 16 | 1 | 05 | 59.2 |
| | 5 | 351 | 33 | 36 | 1 | 04 | 29.8 | | 21 | 352 | 51 | 25 | 1 | 06 | 01.8 |
| | 6 | 351 | 35 | 44 | 1 | 04 | 31.1 | | 22 | 352 | 52 | 31 | 1 | 06 | 04.3 |
| | 7 | 351 | 37 | 50 | -1 | 04 | 32.5 | | 23 | 352 | 53 | 36 | -1 | 06 | 06.9 |
| | 8 | 351 | 39 | 55 | 1 | 04 | 33.9 | | 24 | 352 | 54 | 40 | 1 | 06 | 09.5 |
| | 9 | 351 | 41 | 60 | 1 | 04 | 35.4 | | 25 | 352 | 55 | 41 | 1 | 06 | 12.1 |
| | 10 | 351 | 44 | 04 | 1 | 04 | 36.9 | | 26 | 352 | 56 | 41 | 1 | 06 | 14.7 |
| | 11 | 351 | 46 | 06 | 1 | 04 | 38.4 | | 27 | 352 | 57 | 39 | 1 | 06 | 17.3 |
| | 12 | 351 | 48 | 08 | 1 | 04 | 39.9 | | 28 | 352 | 58 | 36 | 1 | 06 | 20.0 |
| | 13 | 351 | 50 | 09 | -1 | 04 | 41.5 | | 29 | 352 | 59 | 30 | -1 | 06 | 22.6 |
| | 14 | 351 | 52 | 09 | 1 | 04 | 43.1 | | 30 | 353 | 00 | 23 | 1 | 06 | 25.3 |
| | 15 | 351 | 54 | 08 | 1 | 04 | 44.7 | | 31 | 353 | 01 | 14 | 1 | 06 | 28.0 |
| | 16 | 351 | 56 | 07 | 1 | 04 | 46.4 | June | 1 | 353 | 02 | 03 | 1 | 06 | 30.7 |
| | 17 | 351 | 58 | 04 | 1 | 04 | 48.1 | | 2 | 353 | 02 | 50 | 1 | 06 | 33.4 |
| | 18 | 351 | 59 | 60 | 1 | 04 | 49.8 | | 3 | 353 | 03 | 35 | 1 | 06 | 36.1 |
| | 19 | 352 | 01 | 55 | -1 | 04 | 51.6 | | 4 | 353 | 04 | 18 | -1 | 06 | 38.8 |
| | 20 | 352 | 03 | 49 | 1 | 04 | 53.4 | | 5 | 353 | 04 | 59 | 1 | 06 | 41.5 |
| | 21 | 352 | 05 | 41 | 1 | 04 | 55.2 | | 6 | 353 | 05 | 39 | 1 | 06 | 44.2 |
| | 22 | 352 | 07 | 33 | 1 | 04 | 57.1 | | 7 | 353 | 06 | 16 | 1 | 06 | 47.0 |
| | 23 | 352 | 09 | 23 | 1 | 04 | 58.9 | | 8 | 353 | 06 | 52 | 1 | 06 | 49.7 |
| | 24 | 352 | 11 | 12 | 1 | 05 | 00.8 | | 9 | 353 | 07 | 25 | 1 | 06 | 52.5 |
| | 25 | 352 | 12 | 60 | -1 | 05 | 02.8 | | 10 | 353 | 07 | 57 | -1 | 06 | 55.3 |
| | 26 | 352 | 14 | 46 | 1 | 05 | 04.7 | | 11 | 353 | 08 | 27 | 1 | 06 | 58.0 |
| | 27 | 352 | 16 | 32 | 1 | 05 | 06.7 | | 12 | 353 | 08 | 55 | 1 | 07 | 00.8 |
| | 28 | 352 | 18 | 16 | 1 | 05 | 08.8 | | 13 | 353 | 09 | 21 | 1 | 07 | 03.6 |
| | 29 | 352 | 19 | 58 | 1 | 05 | 10.8 | | 14 | 353 | 09 | 45 | 1 | 07 | 06.4 |
| | 30 | 352 | 21 | 40 | 1 | 05 | 12.9 | | 15 | 353 | 10 | 07 | 1 | 07 | 09.1 |
| May | 1 | 352 | 23 | 20 | -1 | 05 | 15.0 | | 16 | 353 | 10 | 27 | -1 | 07 | 11.9 |
| | 2 | 352 | 24 | 59 | 1 | 05 | 17.1 | | 17 | 353 | 10 | 45 | 1 | 07 | 14.7 |
| | 3 | 352 | 26 | 36 | 1 | 05 | 19.3 | | 18 | 353 | 11 | 01 | 1 | 07 | 17.5 |
| | 4 | 352 | 28 | 12 | 1 | 05 | 21.4 | | 19 | 353 | 11 | 15 | 1 | 07 | 20.3 |
| | 5 | 352 | 29 | 47 | 1 | 05 | 23.6 | | 20 | 353 | 11 | 27 | 1 | 07 | 23.1 |
| | 6 | 352 | 31 | 20 | 1 | 05 | 25.9 | | 21 | 353 | 11 | 37 | 1 | 07 | 25.9 |
| | 7 | 352 | 32 | 51 | -1 | 05 | 28.1 | | 22 | 353 | 11 | 45 | -1 | 07 | 28.7 |
| | 8 | 352 | 34 | 21 | 1 | 05 | 30.4 | | 23 | 353 | 11 | 52 | 1 | 07 | 31.5 |
| | 9 | 352 | 35 | 49 | 1 | 05 | 32.7 | | 24 | 353 | 11 | 56 | 1 | 07 | 34.3 |
| | 10 | 352 | 37 | 16 | 1 | 05 | 35.0 | | 25 | 353 | 11 | 59 | 1 | 07 | 37.1 |
| | 11 | 352 | 38 | 41 | 1 | 05 | 37.3 | | 26 | 353 | 11 | 59 | 1 | 07 | 39.9 |
| | 12 | 352 | 40 | 05 | 1 | 05 | 39.7 | | 27 | 353 | 11 | 58 | 1 | 07 | 42.6 |
| | 13 | 352 | 41 | 27 | -1 | 05 | 42.1 | | 28 | 353 | 11 | 54 | -1 | 07 | 45.4 |
| | 14 | 352 | 42 | 48 | 1 | 05 | 44.4 | | 29 | 353 | 11 | 49 | 1 | 07 | 48.2 |
| | 15 | 352 | 44 | 07 | 1 | 05 | 46.9 | | 30 | 353 | 11 | 42 | 1 | 07 | 50.9 |
| | 16 | 352 | 45 | 24 | 1 | 05 | 49.3 | July | 1 | 353 | 11 | 32 | 1 | 07 | 53.7 |
| | 17 | 352 | 46 | 39 | -1 | 05 | 51.8 | | 2 | 353 | 11 | 21 | -1 | 07 | 56.4 |

**NEPTUNE, 2021**
GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ′ | ″ | ° | ′ | ″ | | | ° | ′ | ″ | ° | ′ | ″ |
| July | 1 | 353 | 11 | 32 | -1 | 07 | 53.7 | Aug. | 16 | 352 | 33 | 07 | -1 | 09 | 41.0 |
| | 2 | 353 | 11 | 21 | 1 | 07 | 56.4 | | 17 | 352 | 31 | 43 | 1 | 09 | 42.7 |
| | 3 | 353 | 11 | 08 | 1 | 07 | 59.2 | | 18 | 352 | 30 | 18 | 1 | 09 | 44.4 |
| | 4 | 353 | 10 | 53 | 1 | 08 | 01.9 | | 19 | 352 | 28 | 53 | 1 | 09 | 46.0 |
| | 5 | 353 | 10 | 36 | 1 | 08 | 04.6 | | 20 | 352 | 27 | 26 | 1 | 09 | 47.6 |
| | 6 | 353 | 10 | 17 | 1 | 08 | 07.3 | | 21 | 352 | 25 | 59 | 1 | 09 | 49.1 |
| | 7 | 353 | 09 | 56 | -1 | 08 | 10.0 | | 22 | 352 | 24 | 30 | -1 | 09 | 50.6 |
| | 8 | 353 | 09 | 34 | 1 | 08 | 12.7 | | 23 | 352 | 23 | 01 | 1 | 09 | 52.1 |
| | 9 | 353 | 09 | 09 | 1 | 08 | 15.3 | | 24 | 352 | 21 | 31 | 1 | 09 | 53.5 |
| | 10 | 353 | 08 | 43 | 1 | 08 | 18.0 | | 25 | 352 | 19 | 59 | 1 | 09 | 54.9 |
| | 11 | 353 | 08 | 15 | 1 | 08 | 20.6 | | 26 | 352 | 18 | 28 | 1 | 09 | 56.2 |
| | 12 | 353 | 07 | 45 | 1 | 08 | 23.3 | | 27 | 352 | 16 | 55 | 1 | 09 | 57.5 |
| | 13 | 353 | 07 | 13 | -1 | 08 | 25.9 | | 28 | 352 | 15 | 22 | -1 | 09 | 58.8 |
| | 14 | 353 | 06 | 39 | 1 | 08 | 28.5 | | 29 | 352 | 13 | 48 | 1 | 10 | 00.0 |
| | 15 | 353 | 06 | 04 | 1 | 08 | 31.0 | | 30 | 352 | 12 | 14 | 1 | 10 | 01.2 |
| | 16 | 353 | 05 | 26 | 1 | 08 | 33.6 | | 31 | 352 | 10 | 39 | 1 | 10 | 02.3 |
| | 17 | 353 | 04 | 47 | 1 | 08 | 36.2 | Sept. | 1 | 352 | 09 | 03 | 1 | 10 | 03.4 |
| | 18 | 353 | 04 | 06 | 1 | 08 | 38.7 | | 2 | 352 | 07 | 27 | 1 | 10 | 04.4 |
| | 19 | 353 | 03 | 24 | -1 | 08 | 41.2 | | 3 | 352 | 05 | 51 | -1 | 10 | 05.5 |
| | 20 | 353 | 02 | 39 | 1 | 08 | 43.7 | | 4 | 352 | 04 | 14 | 1 | 10 | 06.4 |
| | 21 | 353 | 01 | 53 | 1 | 08 | 46.2 | | 5 | 352 | 02 | 36 | 1 | 10 | 07.4 |
| | 22 | 353 | 01 | 06 | 1 | 08 | 48.6 | | 6 | 352 | 00 | 58 | 1 | 10 | 08.2 |
| | 23 | 353 | 00 | 17 | 1 | 08 | 51.0 | | 7 | 351 | 59 | 20 | 1 | 10 | 09.1 |
| | 24 | 352 | 59 | 26 | 1 | 08 | 53.4 | | 8 | 351 | 57 | 42 | 1 | 10 | 09.9 |
| | 25 | 352 | 58 | 33 | -1 | 08 | 55.8 | | 9 | 351 | 56 | 03 | -1 | 10 | 10.6 |
| | 26 | 352 | 57 | 39 | 1 | 08 | 58.2 | | 10 | 351 | 54 | 24 | 1 | 10 | 11.4 |
| | 27 | 352 | 56 | 43 | 1 | 09 | 00.5 | | 11 | 351 | 52 | 45 | 1 | 10 | 12.0 |
| | 28 | 352 | 55 | 46 | 1 | 09 | 02.8 | | 12 | 351 | 51 | 05 | 1 | 10 | 12.7 |
| | 29 | 352 | 54 | 47 | 1 | 09 | 05.1 | | 13 | 351 | 49 | 26 | 1 | 10 | 13.3 |
| | 30 | 352 | 53 | 46 | 1 | 09 | 07.3 | | 14 | 351 | 47 | 47 | 1 | 10 | 13.8 |
| | 31 | 352 | 52 | 44 | -1 | 09 | 09.6 | | 15 | 351 | 46 | 08 | -1 | 10 | 14.3 |
| Aug. | 1 | 352 | 51 | 41 | 1 | 09 | 11.8 | | 16 | 351 | 44 | 29 | 1 | 10 | 14.8 |
| | 2 | 352 | 50 | 36 | 1 | 09 | 13.9 | | 17 | 351 | 42 | 50 | 1 | 10 | 15.2 |
| | 3 | 352 | 49 | 30 | 1 | 09 | 16.1 | | 18 | 351 | 41 | 11 | 1 | 10 | 15.5 |
| | 4 | 352 | 48 | 22 | 1 | 09 | 18.2 | | 19 | 351 | 39 | 32 | 1 | 10 | 15.9 |
| | 5 | 352 | 47 | 13 | 1 | 09 | 20.2 | | 20 | 351 | 37 | 53 | 1 | 10 | 16.2 |
| | 6 | 352 | 46 | 02 | -1 | 09 | 22.3 | | 21 | 351 | 36 | 14 | -1 | 10 | 16.4 |
| | 7 | 352 | 44 | 50 | 1 | 09 | 24.3 | | 22 | 351 | 34 | 36 | 1 | 10 | 16.6 |
| | 8 | 352 | 43 | 37 | 1 | 09 | 26.3 | | 23 | 351 | 32 | 57 | 1 | 10 | 16.7 |
| | 9 | 352 | 42 | 23 | 1 | 09 | 28.3 | | 24 | 351 | 31 | 20 | 1 | 10 | 16.8 |
| | 10 | 352 | 41 | 07 | 1 | 09 | 30.2 | | 25 | 351 | 29 | 42 | 1 | 10 | 16.9 |
| | 11 | 352 | 39 | 50 | 1 | 09 | 32.1 | | 26 | 351 | 28 | 05 | 1 | 10 | 16.9 |
| | 12 | 352 | 38 | 31 | -1 | 09 | 33.9 | | 27 | 351 | 26 | 29 | -1 | 10 | 16.9 |
| | 13 | 352 | 37 | 12 | 1 | 09 | 35.8 | | 28 | 351 | 24 | 53 | 1 | 10 | 16.8 |
| | 14 | 352 | 35 | 51 | 1 | 09 | 37.6 | | 29 | 351 | 23 | 17 | 1 | 10 | 16.7 |
| | 15 | 352 | 34 | 30 | 1 | 09 | 39.3 | | 30 | 351 | 21 | 42 | 1 | 10 | 16.5 |
| | 16 | 352 | 33 | 07 | -1 | 09 | 41.0 | Oct. | 1 | 351 | 20 | 08 | -1 | 10 | 16.4 |

**NEPTUNE, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| Oct. | 1 | 351 | 20 | 08 | -1 | 10 | 16.4 | Nov. | 16 | 350 | 28 | 14 | -1 | 09 | 28.6 |
| | 2 | 351 | 18 | 34 | 1 | 10 | 16.1 | | 17 | 350 | 27 | 44 | 1 | 09 | 26.9 |
| | 3 | 351 | 17 | 01 | 1 | 10 | 15.8 | | 18 | 350 | 27 | 16 | 1 | 09 | 25.2 |
| | 4 | 351 | 15 | 29 | -1 | 10 | 15.5 | | 19 | 350 | 26 | 49 | 1 | 09 | 23.4 |
| | 5 | 351 | 13 | 57 | 1 | 10 | 15.2 | | 20 | 350 | 26 | 25 | 1 | 09 | 21.7 |
| | 6 | 351 | 12 | 26 | 1 | 10 | 14.8 | | 21 | 350 | 26 | 03 | 1 | 09 | 20.0 |
| | 7 | 351 | 10 | 56 | -1 | 10 | 14.3 | | 22 | 350 | 25 | 42 | -1 | 09 | 18.2 |
| | 8 | 351 | 09 | 26 | 1 | 10 | 13.8 | | 23 | 350 | 25 | 24 | 1 | 09 | 16.4 |
| | 9 | 351 | 07 | 58 | 1 | 10 | 13.3 | | 24 | 350 | 25 | 08 | 1 | 09 | 14.6 |
| | 10 | 351 | 06 | 31 | 1 | 10 | 12.8 | | 25 | 350 | 24 | 53 | 1 | 09 | 12.8 |
| | 11 | 351 | 05 | 04 | 1 | 10 | 12.2 | | 26 | 350 | 24 | 41 | 1 | 09 | 11.0 |
| | 12 | 351 | 03 | 39 | 1 | 10 | 11.5 | | 27 | 350 | 24 | 30 | 1 | 09 | 09.2 |
| | 13 | 351 | 02 | 15 | -1 | 10 | 10.9 | | 28 | 350 | 24 | 22 | -1 | 09 | 07.4 |
| | 14 | 351 | 00 | 51 | 1 | 10 | 10.2 | | 29 | 350 | 24 | 16 | 1 | 09 | 05.5 |
| | 15 | 350 | 59 | 29 | 1 | 10 | 09.4 | | 30 | 350 | 24 | 11 | 1 | 09 | 03.7 |
| | 16 | 350 | 58 | 08 | 1 | 10 | 08.6 | Dec. | 1 | 350 | 24 | 09 | 1 | 09 | 01.9 |
| | 17 | 350 | 56 | 48 | 1 | 10 | 07.8 | | 2 | 350 | 24 | 09 | 1 | 09 | 00.0 |
| | 18 | 350 | 55 | 29 | 1 | 10 | 06.9 | | 3 | 350 | 24 | 11 | 1 | 08 | 58.1 |
| | 19 | 350 | 54 | 12 | -1 | 10 | 06.0 | | 4 | 350 | 24 | 15 | -1 | 08 | 56.3 |
| | 20 | 350 | 52 | 56 | 1 | 10 | 05.1 | | 5 | 350 | 24 | 22 | 1 | 08 | 54.4 |
| | 21 | 350 | 51 | 41 | 1 | 10 | 04.1 | | 6 | 350 | 24 | 30 | 1 | 08 | 52.5 |
| | 22 | 350 | 50 | 27 | 1 | 10 | 03.1 | | 7 | 350 | 24 | 41 | 1 | 08 | 50.7 |
| | 23 | 350 | 49 | 15 | 1 | 10 | 02.1 | | 8 | 350 | 24 | 53 | 1 | 08 | 48.8 |
| | 24 | 350 | 48 | 04 | 1 | 10 | 01.0 | | 9 | 350 | 25 | 08 | 1 | 08 | 46.9 |
| | 25 | 350 | 46 | 54 | -1 | 09 | 59.9 | | 10 | 350 | 25 | 25 | -1 | 08 | 45.0 |
| | 26 | 350 | 45 | 46 | 1 | 09 | 58.7 | | 11 | 350 | 25 | 43 | 1 | 08 | 43.1 |
| | 27 | 350 | 44 | 40 | 1 | 09 | 57.6 | | 12 | 350 | 26 | 04 | 1 | 08 | 41.2 |
| | 28 | 350 | 43 | 35 | 1 | 09 | 56.4 | | 13 | 350 | 26 | 27 | 1 | 08 | 39.4 |
| | 29 | 350 | 42 | 31 | 1 | 09 | 55.1 | | 14 | 350 | 26 | 52 | 1 | 08 | 37.5 |
| | 30 | 350 | 41 | 29 | 1 | 09 | 53.9 | | 15 | 350 | 27 | 19 | 1 | 08 | 35.6 |
| | 31 | 350 | 40 | 29 | -1 | 09 | 52.6 | | 16 | 350 | 27 | 48 | -1 | 08 | 33.7 |
| Nov. | 1 | 350 | 39 | 30 | 1 | 09 | 51.3 | | 17 | 350 | 28 | 19 | 1 | 08 | 31.9 |
| | 2 | 350 | 38 | 32 | 1 | 09 | 49.9 | | 18 | 350 | 28 | 52 | 1 | 08 | 30.0 |
| | 3 | 350 | 37 | 36 | 1 | 09 | 48.6 | | 19 | 350 | 29 | 28 | 1 | 08 | 28.1 |
| | 4 | 350 | 36 | 42 | 1 | 09 | 47.2 | | 20 | 350 | 30 | 05 | 1 | 08 | 26.3 |
| | 5 | 350 | 35 | 50 | 1 | 09 | 45.7 | | 21 | 350 | 30 | 45 | 1 | 08 | 24.5 |
| | 6 | 350 | 34 | 60 | -1 | 09 | 44.3 | | 22 | 350 | 31 | 26 | -1 | 08 | 22.6 |
| | 7 | 350 | 34 | 11 | 1 | 09 | 42.8 | | 23 | 350 | 32 | 10 | 1 | 08 | 20.8 |
| | 8 | 350 | 33 | 24 | 1 | 09 | 41.3 | | 24 | 350 | 32 | 55 | 1 | 08 | 19.0 |
| | 9 | 350 | 32 | 39 | 1 | 09 | 39.8 | | 25 | 350 | 33 | 42 | 1 | 08 | 17.2 |
| | 10 | 350 | 31 | 56 | 1 | 09 | 38.3 | | 26 | 350 | 34 | 32 | 1 | 08 | 15.4 |
| | 11 | 350 | 31 | 14 | 1 | 09 | 36.7 | | 27 | 350 | 35 | 23 | 1 | 08 | 13.6 |
| | 12 | 350 | 30 | 35 | -1 | 09 | 35.1 | | 28 | 350 | 36 | 16 | -1 | 08 | 11.9 |
| | 13 | 350 | 29 | 57 | 1 | 09 | 33.5 | | 29 | 350 | 37 | 11 | 1 | 08 | 10.1 |
| | 14 | 350 | 29 | 21 | 1 | 09 | 31.9 | | 30 | 350 | 38 | 08 | 1 | 08 | 08.4 |
| | 15 | 350 | 28 | 47 | 1 | 09 | 30.2 | | 31 | 350 | 39 | 08 | 1 | 08 | 06.6 |
| | 16 | 350 | 28 | 14 | -1 | 09 | 28.6 | | 32 | 350 | 40 | 09 | -1 | 08 | 04.9 |

**NEPTUNE, 2021**
RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Jan. | 0 | 23 | 19 | 14.36 | -5 | 33 | 39.6 | 30.270 185 | 0.29 | 1.11 | 16 | 37 | 02 |
| | 1 | 23 | 19 | 18.37 | 5 | 33 | 12.4 | 30.286 298 | 0.29 | 1.11 | 16 | 33 | 11 |
| | 2 | 23 | 19 | 22.50 | 5 | 32 | 44.5 | 30.302 298 | 0.29 | 1.11 | 16 | 29 | 19 |
| | 3 | 23 | 19 | 26.74 | 5 | 32 | 16.0 | 30.318 181 | 0.29 | 1.10 | 16 | 25 | 27 |
| | 4 | 23 | 19 | 31.08 | 5 | 31 | 46.7 | 30.333 944 | 0.29 | 1.10 | 16 | 21 | 36 |
| | 5 | 23 | 19 | 35.54 | 5 | 31 | 16.8 | 30.349 580 | 0.29 | 1.10 | 16 | 17 | 44 |
| | 6 | 23 | 19 | 40.10 | -5 | 30 | 46.2 | 30.365 086 | 0.29 | 1.10 | 16 | 13 | 53 |
| | 7 | 23 | 19 | 44.78 | 5 | 30 | 14.9 | 30.380 458 | 0.29 | 1.10 | 16 | 10 | 02 |
| | 8 | 23 | 19 | 49.57 | 5 | 29 | 42.9 | 30.395 689 | 0.29 | 1.10 | 16 | 06 | 11 |
| | 9 | 23 | 19 | 54.47 | 5 | 29 | 10.2 | 30.410 776 | 0.29 | 1.10 | 16 | 02 | 20 |
| | 10 | 23 | 19 | 59.48 | 5 | 28 | 36.9 | 30.425 714 | 0.29 | 1.10 | 15 | 58 | 29 |
| | 11 | 23 | 20 | 04.59 | 5 | 28 | 02.9 | 30.440 498 | 0.29 | 1.10 | 15 | 54 | 38 |
| | 12 | 23 | 20 | 09.82 | -5 | 27 | 28.2 | 30.455 124 | 0.29 | 1.10 | 15 | 50 | 47 |
| | 13 | 23 | 20 | 15.14 | 5 | 26 | 52.9 | 30.469 585 | 0.29 | 1.10 | 15 | 46 | 57 |
| | 14 | 23 | 20 | 20.57 | 5 | 26 | 17.0 | 30.483 879 | 0.29 | 1.10 | 15 | 43 | 06 |
| | 15 | 23 | 20 | 26.09 | 5 | 25 | 40.5 | 30.498 001 | 0.29 | 1.10 | 15 | 39 | 16 |
| | 16 | 23 | 20 | 31.71 | 5 | 25 | 03.4 | 30.511 945 | 0.29 | 1.10 | 15 | 35 | 26 |
| | 17 | 23 | 20 | 37.42 | 5 | 24 | 25.7 | 30.525 709 | 0.29 | 1.10 | 15 | 31 | 36 |
| | 18 | 23 | 20 | 43.22 | -5 | 23 | 47.5 | 30.539 288 | 0.29 | 1.10 | 15 | 27 | 46 |
| | 19 | 23 | 20 | 49.12 | 5 | 23 | 08.7 | 30.552 679 | 0.29 | 1.10 | 15 | 23 | 56 |
| | 20 | 23 | 20 | 55.11 | 5 | 22 | 29.3 | 30.565 877 | 0.29 | 1.10 | 15 | 20 | 06 |
| | 21 | 23 | 21 | 01.19 | 5 | 21 | 49.3 | 30.578 879 | 0.29 | 1.10 | 15 | 16 | 16 |
| | 22 | 23 | 21 | 07.37 | 5 | 21 | 08.8 | 30.591 681 | 0.29 | 1.10 | 15 | 12 | 26 |
| | 23 | 23 | 21 | 13.63 | 5 | 20 | 27.8 | 30.604 281 | 0.29 | 1.09 | 15 | 08 | 37 |
| | 24 | 23 | 21 | 19.98 | -5 | 19 | 46.2 | 30.616 674 | 0.29 | 1.09 | 15 | 04 | 47 |
| | 25 | 23 | 21 | 26.42 | 5 | 19 | 04.1 | 30.628 858 | 0.29 | 1.09 | 15 | 00 | 58 |
| | 26 | 23 | 21 | 32.94 | 5 | 18 | 21.4 | 30.640 830 | 0.29 | 1.09 | 14 | 57 | 08 |
| | 27 | 23 | 21 | 39.55 | 5 | 17 | 38.3 | 30.652 585 | 0.29 | 1.09 | 14 | 53 | 19 |
| | 28 | 23 | 21 | 46.23 | 5 | 16 | 54.7 | 30.664 123 | 0.29 | 1.09 | 14 | 49 | 30 |
| | 29 | 23 | 21 | 52.99 | 5 | 16 | 10.7 | 30.675 439 | 0.29 | 1.09 | 14 | 45 | 41 |
| | 30 | 23 | 21 | 59.82 | -5 | 15 | 26.2 | 30.686 531 | 0.29 | 1.09 | 14 | 41 | 51 |
| | 31 | 23 | 22 | 06.72 | 5 | 14 | 41.3 | 30.697 396 | 0.29 | 1.09 | 14 | 38 | 02 |
| Feb. | 1 | 23 | 22 | 13.70 | 5 | 13 | 56.0 | 30.708 031 | 0.29 | 1.09 | 14 | 34 | 14 |
| | 2 | 23 | 22 | 20.74 | 5 | 13 | 10.2 | 30.718 433 | 0.29 | 1.09 | 14 | 30 | 25 |
| | 3 | 23 | 22 | 27.86 | 5 | 12 | 24.0 | 30.728 599 | 0.29 | 1.09 | 14 | 26 | 36 |
| | 4 | 23 | 22 | 35.04 | 5 | 11 | 37.4 | 30.738 527 | 0.29 | 1.09 | 14 | 22 | 47 |
| | 5 | 23 | 22 | 42.30 | -5 | 10 | 50.4 | 30.748 214 | 0.29 | 1.09 | 14 | 18 | 59 |
| | 6 | 23 | 22 | 49.62 | 5 | 10 | 03.0 | 30.757 656 | 0.29 | 1.09 | 14 | 15 | 10 |
| | 7 | 23 | 22 | 57.01 | 5 | 09 | 15.1 | 30.766 850 | 0.29 | 1.09 | 14 | 11 | 21 |
| | 8 | 23 | 23 | 04.47 | 5 | 08 | 26.9 | 30.775 794 | 0.29 | 1.09 | 14 | 07 | 33 |
| | 9 | 23 | 23 | 11.98 | 5 | 07 | 38.4 | 30.784 485 | 0.29 | 1.09 | 14 | 03 | 45 |
| | 10 | 23 | 23 | 19.55 | 5 | 06 | 49.5 | 30.792 920 | 0.29 | 1.09 | 13 | 59 | 56 |
| | 11 | 23 | 23 | 27.18 | -5 | 06 | 00.3 | 30.801 097 | 0.29 | 1.09 | 13 | 56 | 08 |
| | 12 | 23 | 23 | 34.86 | 5 | 05 | 10.8 | 30.809 013 | 0.29 | 1.09 | 13 | 52 | 20 |
| | 13 | 23 | 23 | 42.58 | 5 | 04 | 21.0 | 30.816 666 | 0.29 | 1.09 | 13 | 48 | 31 |
| | 14 | 23 | 23 | 50.36 | 5 | 03 | 30.9 | 30.824 054 | 0.29 | 1.09 | 13 | 44 | 43 |
| | 15 | 23 | 23 | 58.18 | -5 | 02 | 40.6 | 30.831 175 | 0.29 | 1.09 | 13 | 40 | 55 |

**NEPTUNE, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Feb. | 15 | 23 | 23 | 58.18 | -5 | 02 | 40.6 | 30.831 175 | 0.29 | 1.09 | 13 | 40 | 55 |
| | 16 | 23 | 24 | 06.04 | 5 | 01 | 50.0 | 30.838 027 | 0.29 | 1.09 | 13 | 37 | 07 |
| | 17 | 23 | 24 | 13.96 | 5 | 00 | 59.1 | 30.844 609 | 0.29 | 1.09 | 13 | 33 | 19 |
| | 18 | 23 | 24 | 21.91 | 5 | 00 | 08.0 | 30.850 919 | 0.29 | 1.09 | 13 | 29 | 31 |
| | 19 | 23 | 24 | 29.91 | 4 | 59 | 16.6 | 30.856 956 | 0.28 | 1.09 | 13 | 25 | 43 |
| | 20 | 23 | 24 | 37.95 | 4 | 58 | 25.0 | 30.862 719 | 0.28 | 1.09 | 13 | 21 | 55 |
| | 21 | 23 | 24 | 46.03 | -4 | 57 | 33.2 | 30.868 206 | 0.28 | 1.09 | 13 | 18 | 08 |
| | 22 | 23 | 24 | 54.15 | 4 | 56 | 41.2 | 30.873 417 | 0.28 | 1.09 | 13 | 14 | 20 |
| | 23 | 23 | 25 | 02.29 | 4 | 55 | 49.0 | 30.878 350 | 0.28 | 1.08 | 13 | 10 | 32 |
| | 24 | 23 | 25 | 10.47 | 4 | 54 | 56.6 | 30.883 004 | 0.28 | 1.08 | 13 | 06 | 44 |
| | 25 | 23 | 25 | 18.68 | 4 | 54 | 04.1 | 30.887 380 | 0.28 | 1.08 | 13 | 02 | 56 |
| | 26 | 23 | 25 | 26.91 | 4 | 53 | 11.5 | 30.891 476 | 0.28 | 1.08 | 12 | 59 | 09 |
| | 27 | 23 | 25 | 35.17 | -4 | 52 | 18.7 | 30.895 291 | 0.28 | 1.08 | 12 | 55 | 21 |
| | 28 | 23 | 25 | 43.44 | 4 | 51 | 25.9 | 30.898 825 | 0.28 | 1.08 | 12 | 51 | 33 |
| Mar. | 1 | 23 | 25 | 51.74 | 4 | 50 | 33.0 | 30.902 078 | 0.28 | 1.08 | 12 | 47 | 46 |
| | 2 | 23 | 26 | 00.05 | 4 | 49 | 39.9 | 30.905 048 | 0.28 | 1.08 | 12 | 43 | 58 |
| | 3 | 23 | 26 | 08.39 | 4 | 48 | 46.8 | 30.907 734 | 0.28 | 1.08 | 12 | 40 | 11 |
| | 4 | 23 | 26 | 16.74 | 4 | 47 | 53.6 | 30.910 137 | 0.28 | 1.08 | 12 | 36 | 23 |
| | 5 | 23 | 26 | 25.11 | -4 | 47 | 00.2 | 30.912 255 | 0.28 | 1.08 | 12 | 32 | 35 |
| | 6 | 23 | 26 | 33.50 | 4 | 46 | 06.9 | 30.914 087 | 0.28 | 1.08 | 12 | 28 | 48 |
| | 7 | 23 | 26 | 41.91 | 4 | 45 | 13.4 | 30.915 634 | 0.28 | 1.08 | 12 | 25 | 00 |
| | 8 | 23 | 26 | 50.32 | 4 | 44 | 20.0 | 30.916 893 | 0.28 | 1.08 | 12 | 21 | 13 |
| | 9 | 23 | 26 | 58.74 | 4 | 43 | 26.5 | 30.917 865 | 0.28 | 1.08 | 12 | 17 | 25 |
| | 10 | 23 | 27 | 07.17 | 4 | 42 | 33.2 | 30.918 549 | 0.28 | 1.08 | 12 | 13 | 38 |
| | 11 | 23 | 27 | 15.58 | -4 | 41 | 40.0 | 30.918 945 | 0.28 | 1.08 | 12 | 09 | 50 |
| | 12 | 23 | 27 | 23.98 | 4 | 40 | 46.6 | 30.919 053 | 0.28 | 1.08 | 12 | 06 | 03 |
| | 13 | 23 | 27 | 32.39 | 4 | 39 | 53.1 | 30.918 874 | 0.28 | 1.08 | 12 | 02 | 15 |
| | 14 | 23 | 27 | 40.81 | 4 | 38 | 59.8 | 30.918 406 | 0.28 | 1.08 | 11 | 58 | 27 |
| | 15 | 23 | 27 | 49.21 | 4 | 38 | 06.5 | 30.917 651 | 0.28 | 1.08 | 11 | 54 | 40 |
| | 16 | 23 | 27 | 57.61 | 4 | 37 | 13.4 | 30.916 610 | 0.28 | 1.08 | 11 | 50 | 52 |
| | 17 | 23 | 28 | 06.00 | -4 | 36 | 20.3 | 30.915 283 | 0.28 | 1.08 | 11 | 47 | 05 |
| | 18 | 23 | 28 | 14.39 | 4 | 35 | 27.3 | 30.913 670 | 0.28 | 1.08 | 11 | 43 | 17 |
| | 19 | 23 | 28 | 22.76 | 4 | 34 | 34.5 | 30.911 773 | 0.28 | 1.08 | 11 | 39 | 30 |
| | 20 | 23 | 28 | 31.12 | 4 | 33 | 41.7 | 30.909 592 | 0.28 | 1.08 | 11 | 35 | 42 |
| | 21 | 23 | 28 | 39.46 | 4 | 32 | 49.1 | 30.907 130 | 0.28 | 1.08 | 11 | 31 | 54 |
| | 22 | 23 | 28 | 47.79 | 4 | 31 | 56.6 | 30.904 386 | 0.28 | 1.08 | 11 | 28 | 07 |
| | 23 | 23 | 28 | 56.10 | -4 | 31 | 04.3 | 30.901 362 | 0.28 | 1.08 | 11 | 24 | 19 |
| | 24 | 23 | 29 | 04.38 | 4 | 30 | 12.1 | 30.898 060 | 0.28 | 1.08 | 11 | 20 | 31 |
| | 25 | 23 | 29 | 12.64 | 4 | 29 | 20.2 | 30.894 481 | 0.28 | 1.08 | 11 | 16 | 44 |
| | 26 | 23 | 29 | 20.87 | 4 | 28 | 28.5 | 30.890 627 | 0.28 | 1.08 | 11 | 12 | 56 |
| | 27 | 23 | 29 | 29.07 | 4 | 27 | 37.0 | 30.886 499 | 0.28 | 1.08 | 11 | 09 | 08 |
| | 28 | 23 | 29 | 37.23 | 4 | 26 | 45.7 | 30.882 098 | 0.28 | 1.08 | 11 | 05 | 20 |
| | 29 | 23 | 29 | 45.37 | -4 | 25 | 54.7 | 30.877 426 | 0.28 | 1.08 | 11 | 01 | 33 |
| | 30 | 23 | 29 | 53.47 | 4 | 25 | 03.9 | 30.872 485 | 0.28 | 1.09 | 10 | 57 | 45 |
| | 31 | 23 | 30 | 01.55 | 4 | 24 | 13.3 | 30.867 275 | 0.28 | 1.09 | 10 | 53 | 57 |
| Apr. | 1 | 23 | 30 | 09.59 | 4 | 23 | 23.0 | 30.861 799 | 0.28 | 1.09 | 10 | 50 | 09 |
| | 2 | 23 | 30 | 17.60 | -4 | 22 | 32.9 | 30.856 056 | 0.29 | 1.09 | 10 | 46 | 21 |

**NEPTUNE, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Apr. | 1 | 23 | 30 | 09.59 | -4 | 23 | 23.0 | 30.861 799 | 0.28 | 1.09 | 10 | 50 | 09 |
| | 2 | 23 | 30 | 17.60 | 4 | 22 | 32.9 | 30.856 056 | 0.29 | 1.09 | 10 | 46 | 21 |
| | 3 | 23 | 30 | 25.57 | 4 | 21 | 43.1 | 30.850 050 | 0.29 | 1.09 | 10 | 42 | 33 |
| | 4 | 23 | 30 | 33.50 | 4 | 20 | 53.5 | 30.843 780 | 0.29 | 1.09 | 10 | 38 | 45 |
| | 5 | 23 | 30 | 41.39 | 4 | 20 | 04.3 | 30.837 249 | 0.29 | 1.09 | 10 | 34 | 57 |
| | 6 | 23 | 30 | 49.23 | 4 | 19 | 15.4 | 30.830 458 | 0.29 | 1.09 | 10 | 31 | 09 |
| | 7 | 23 | 30 | 57.02 | -4 | 18 | 26.9 | 30.823 409 | 0.29 | 1.09 | 10 | 27 | 21 |
| | 8 | 23 | 31 | 04.76 | 4 | 17 | 38.7 | 30.816 104 | 0.29 | 1.09 | 10 | 23 | 32 |
| | 9 | 23 | 31 | 12.45 | 4 | 16 | 50.9 | 30.808 544 | 0.29 | 1.09 | 10 | 19 | 44 |
| | 10 | 23 | 31 | 20.09 | 4 | 16 | 03.5 | 30.800 733 | 0.29 | 1.09 | 10 | 15 | 56 |
| | 11 | 23 | 31 | 27.67 | 4 | 15 | 16.4 | 30.792 672 | 0.29 | 1.09 | 10 | 12 | 07 |
| | 12 | 23 | 31 | 35.20 | 4 | 14 | 29.7 | 30.784 363 | 0.29 | 1.09 | 10 | 08 | 19 |
| | 13 | 23 | 31 | 42.67 | -4 | 13 | 43.4 | 30.775 810 | 0.29 | 1.09 | 10 | 04 | 30 |
| | 14 | 23 | 31 | 50.09 | 4 | 12 | 57.4 | 30.767 015 | 0.29 | 1.09 | 10 | 00 | 42 |
| | 15 | 23 | 31 | 57.44 | 4 | 12 | 11.9 | 30.757 981 | 0.29 | 1.09 | 9 | 56 | 53 |
| | 16 | 23 | 32 | 04.74 | 4 | 11 | 26.8 | 30.748 710 | 0.29 | 1.09 | 9 | 53 | 05 |
| | 17 | 23 | 32 | 11.98 | 4 | 10 | 42.1 | 30.739 206 | 0.29 | 1.09 | 9 | 49 | 16 |
| | 18 | 23 | 32 | 19.15 | 4 | 09 | 57.9 | 30.729 471 | 0.29 | 1.09 | 9 | 45 | 27 |
| | 19 | 23 | 32 | 26.26 | -4 | 09 | 14.1 | 30.719 509 | 0.29 | 1.09 | 9 | 41 | 38 |
| | 20 | 23 | 32 | 33.30 | 4 | 08 | 30.8 | 30.709 323 | 0.29 | 1.09 | 9 | 37 | 49 |
| | 21 | 23 | 32 | 40.26 | 4 | 07 | 47.9 | 30.698 916 | 0.29 | 1.09 | 9 | 34 | 00 |
| | 22 | 23 | 32 | 47.16 | 4 | 07 | 05.6 | 30.688 290 | 0.29 | 1.09 | 9 | 30 | 11 |
| | 23 | 23 | 32 | 53.98 | 4 | 06 | 23.8 | 30.677 451 | 0.29 | 1.09 | 9 | 26 | 22 |
| | 24 | 23 | 33 | 00.72 | 4 | 05 | 42.5 | 30.666 400 | 0.29 | 1.09 | 9 | 22 | 33 |
| | 25 | 23 | 33 | 07.38 | -4 | 05 | 01.7 | 30.655 141 | 0.29 | 1.09 | 9 | 18 | 43 |
| | 26 | 23 | 33 | 13.97 | 4 | 04 | 21.4 | 30.643 678 | 0.29 | 1.09 | 9 | 14 | 54 |
| | 27 | 23 | 33 | 20.49 | 4 | 03 | 41.7 | 30.632 012 | 0.29 | 1.09 | 9 | 11 | 05 |
| | 28 | 23 | 33 | 26.93 | 4 | 03 | 02.4 | 30.620 148 | 0.29 | 1.09 | 9 | 07 | 15 |
| | 29 | 23 | 33 | 33.29 | 4 | 02 | 23.7 | 30.608 088 | 0.29 | 1.09 | 9 | 03 | 25 |
| | 30 | 23 | 33 | 39.58 | 4 | 01 | 45.5 | 30.595 835 | 0.29 | 1.09 | 8 | 59 | 36 |
| May | 1 | 23 | 33 | 45.78 | -4 | 01 | 07.8 | 30.583 392 | 0.29 | 1.10 | 8 | 55 | 46 |
| | 2 | 23 | 33 | 51.90 | 4 | 00 | 30.7 | 30.570 762 | 0.29 | 1.10 | 8 | 51 | 56 |
| | 3 | 23 | 33 | 57.94 | 3 | 59 | 54.2 | 30.557 949 | 0.29 | 1.10 | 8 | 48 | 06 |
| | 4 | 23 | 34 | 03.88 | 3 | 59 | 18.3 | 30.544 954 | 0.29 | 1.10 | 8 | 44 | 16 |
| | 5 | 23 | 34 | 09.73 | 3 | 58 | 43.0 | 30.531 783 | 0.29 | 1.10 | 8 | 40 | 26 |
| | 6 | 23 | 34 | 15.50 | 3 | 58 | 08.4 | 30.518 438 | 0.29 | 1.10 | 8 | 36 | 36 |
| | 7 | 23 | 34 | 21.16 | -3 | 57 | 34.3 | 30.504 922 | 0.29 | 1.10 | 8 | 32 | 46 |
| | 8 | 23 | 34 | 26.74 | 3 | 57 | 00.9 | 30.491 241 | 0.29 | 1.10 | 8 | 28 | 55 |
| | 9 | 23 | 34 | 32.22 | 3 | 56 | 28.0 | 30.477 396 | 0.29 | 1.10 | 8 | 25 | 05 |
| | 10 | 23 | 34 | 37.61 | 3 | 55 | 55.9 | 30.463 394 | 0.29 | 1.10 | 8 | 21 | 14 |
| | 11 | 23 | 34 | 42.90 | 3 | 55 | 24.3 | 30.449 236 | 0.29 | 1.10 | 8 | 17 | 23 |
| | 12 | 23 | 34 | 48.10 | 3 | 54 | 53.3 | 30.434 929 | 0.29 | 1.10 | 8 | 13 | 33 |
| | 13 | 23 | 34 | 53.20 | -3 | 54 | 23.0 | 30.420 475 | 0.29 | 1.10 | 8 | 09 | 42 |
| | 14 | 23 | 34 | 58.21 | 3 | 53 | 53.4 | 30.405 879 | 0.29 | 1.10 | 8 | 05 | 51 |
| | 15 | 23 | 35 | 03.12 | 3 | 53 | 24.4 | 30.391 145 | 0.29 | 1.10 | 8 | 01 | 60 |
| | 16 | 23 | 35 | 07.92 | 3 | 52 | 56.1 | 30.376 278 | 0.29 | 1.10 | 7 | 58 | 09 |
| | 17 | 23 | 35 | 12.63 | -3 | 52 | 28.4 | 30.361 282 | 0.29 | 1.10 | 7 | 54 | 17 |

**NEPTUNE, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| May | 17 | 23 | 35 | 12.63 | -3 | 52 | 28.4 | 30.361 282 | 0.29 | 1.10 | 7 | 54 | 17 |
| | 18 | 23 | 35 | 17.23 | 3 | 52 | 01.5 | 30.346 162 | 0.29 | 1.10 | 7 | 50 | 26 |
| | 19 | 23 | 35 | 21.72 | 3 | 51 | 35.3 | 30.330 922 | 0.29 | 1.10 | 7 | 46 | 34 |
| | 20 | 23 | 35 | 26.10 | 3 | 51 | 09.8 | 30.315 566 | 0.29 | 1.11 | 7 | 42 | 43 |
| | 21 | 23 | 35 | 30.38 | 3 | 50 | 45.0 | 30.300 099 | 0.29 | 1.11 | 7 | 38 | 51 |
| | 22 | 23 | 35 | 34.55 | 3 | 50 | 20.9 | 30.284 525 | 0.29 | 1.11 | 7 | 34 | 59 |
| | 23 | 23 | 35 | 38.61 | -3 | 49 | 57.5 | 30.268 849 | 0.29 | 1.11 | 7 | 31 | 07 |
| | 24 | 23 | 35 | 42.56 | 3 | 49 | 34.8 | 30.253 074 | 0.29 | 1.11 | 7 | 27 | 15 |
| | 25 | 23 | 35 | 46.41 | 3 | 49 | 12.9 | 30.237 206 | 0.29 | 1.11 | 7 | 23 | 23 |
| | 26 | 23 | 35 | 50.15 | 3 | 48 | 51.6 | 30.221 247 | 0.29 | 1.11 | 7 | 19 | 31 |
| | 27 | 23 | 35 | 53.79 | 3 | 48 | 31.0 | 30.205 202 | 0.29 | 1.11 | 7 | 15 | 39 |
| | 28 | 23 | 35 | 57.31 | 3 | 48 | 11.1 | 30.189 076 | 0.29 | 1.11 | 7 | 11 | 46 |
| | 29 | 23 | 36 | 00.73 | -3 | 47 | 51.9 | 30.172 871 | 0.29 | 1.11 | 7 | 07 | 54 |
| | 30 | 23 | 36 | 04.04 | 3 | 47 | 33.5 | 30.156 592 | 0.29 | 1.11 | 7 | 04 | 01 |
| | 31 | 23 | 36 | 07.23 | 3 | 47 | 15.9 | 30.140 243 | 0.29 | 1.11 | 7 | 00 | 08 |
| June | 1 | 23 | 36 | 10.30 | 3 | 46 | 59.0 | 30.123 828 | 0.29 | 1.11 | 6 | 56 | 15 |
| | 2 | 23 | 36 | 13.25 | 3 | 46 | 42.9 | 30.107 352 | 0.29 | 1.11 | 6 | 52 | 22 |
| | 3 | 23 | 36 | 16.09 | 3 | 46 | 27.6 | 30.090 818 | 0.29 | 1.11 | 6 | 48 | 29 |
| | 4 | 23 | 36 | 18.81 | -3 | 46 | 13.0 | 30.074 232 | 0.29 | 1.11 | 6 | 44 | 36 |
| | 5 | 23 | 36 | 21.41 | 3 | 45 | 59.2 | 30.057 598 | 0.29 | 1.11 | 6 | 40 | 43 |
| | 6 | 23 | 36 | 23.90 | 3 | 45 | 46.1 | 30.040 921 | 0.29 | 1.12 | 6 | 36 | 49 |
| | 7 | 23 | 36 | 26.27 | 3 | 45 | 33.8 | 30.024 206 | 0.29 | 1.12 | 6 | 32 | 56 |
| | 8 | 23 | 36 | 28.52 | 3 | 45 | 22.3 | 30.007 457 | 0.29 | 1.12 | 6 | 29 | 02 |
| | 9 | 23 | 36 | 30.66 | 3 | 45 | 11.5 | 29.990 680 | 0.29 | 1.12 | 6 | 25 | 08 |
| | 10 | 23 | 36 | 32.68 | -3 | 45 | 01.4 | 29.973 878 | 0.29 | 1.12 | 6 | 21 | 14 |
| | 11 | 23 | 36 | 34.59 | 3 | 44 | 52.2 | 29.957 058 | 0.29 | 1.12 | 6 | 17 | 20 |
| | 12 | 23 | 36 | 36.38 | 3 | 44 | 43.6 | 29.940 224 | 0.29 | 1.12 | 6 | 13 | 26 |
| | 13 | 23 | 36 | 38.04 | 3 | 44 | 35.9 | 29.923 381 | 0.29 | 1.12 | 6 | 09 | 32 |
| | 14 | 23 | 36 | 39.59 | 3 | 44 | 29.0 | 29.906 534 | 0.29 | 1.12 | 6 | 05 | 37 |
| | 15 | 23 | 36 | 41.01 | 3 | 44 | 22.9 | 29.889 689 | 0.29 | 1.12 | 6 | 01 | 43 |
| | 16 | 23 | 36 | 42.31 | -3 | 44 | 17.5 | 29.872 849 | 0.29 | 1.12 | 5 | 57 | 48 |
| | 17 | 23 | 36 | 43.49 | 3 | 44 | 13.0 | 29.856 020 | 0.29 | 1.12 | 5 | 53 | 53 |
| | 18 | 23 | 36 | 44.54 | 3 | 44 | 09.2 | 29.839 208 | 0.29 | 1.12 | 5 | 49 | 58 |
| | 19 | 23 | 36 | 45.47 | 3 | 44 | 06.2 | 29.822 415 | 0.29 | 1.12 | 5 | 46 | 03 |
| | 20 | 23 | 36 | 46.29 | 3 | 44 | 04.0 | 29.805 648 | 0.30 | 1.12 | 5 | 42 | 08 |
| | 21 | 23 | 36 | 46.98 | 3 | 44 | 02.6 | 29.788 911 | 0.30 | 1.12 | 5 | 38 | 13 |
| | 22 | 23 | 36 | 47.56 | -3 | 44 | 01.9 | 29.772 208 | 0.30 | 1.13 | 5 | 34 | 18 |
| | 23 | 23 | 36 | 48.03 | 3 | 44 | 01.9 | 29.755 544 | 0.30 | 1.13 | 5 | 30 | 22 |
| | 24 | 23 | 36 | 48.37 | 3 | 44 | 02.7 | 29.738 923 | 0.30 | 1.13 | 5 | 26 | 27 |
| | 25 | 23 | 36 | 48.61 | 3 | 44 | 04.3 | 29.722 349 | 0.30 | 1.13 | 5 | 22 | 31 |
| | 26 | 23 | 36 | 48.72 | 3 | 44 | 06.6 | 29.705 826 | 0.30 | 1.13 | 5 | 18 | 35 |
| | 27 | 23 | 36 | 48.71 | 3 | 44 | 09.7 | 29.689 358 | 0.30 | 1.13 | 5 | 14 | 39 |
| | 28 | 23 | 36 | 48.57 | -3 | 44 | 13.6 | 29.672 951 | 0.30 | 1.13 | 5 | 10 | 43 |
| | 29 | 23 | 36 | 48.31 | 3 | 44 | 18.3 | 29.656 608 | 0.30 | 1.13 | 5 | 06 | 47 |
| | 30 | 23 | 36 | 47.94 | 3 | 44 | 23.7 | 29.640 334 | 0.30 | 1.13 | 5 | 02 | 51 |
| July | 1 | 23 | 36 | 47.44 | 3 | 44 | 29.9 | 29.624 133 | 0.30 | 1.13 | 4 | 58 | 54 |
| | 2 | 23 | 36 | 46.82 | -3 | 44 | 36.9 | 29.608 010 | 0.30 | 1.13 | 4 | 54 | 58 |

**NEPTUNE, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| July | 1 | 23 | 36 | 47.44 | -3 | 44 | 29.9 | 29.624 133 | 0.30 | 1.13 | 4 | 58 | 54 |
| | 2 | 23 | 36 | 46.82 | 3 | 44 | 36.9 | 29.608 010 | 0.30 | 1.13 | 4 | 54 | 58 |
| | 3 | 23 | 36 | 46.08 | 3 | 44 | 44.6 | 29.591 970 | 0.30 | 1.13 | 4 | 51 | 01 |
| | 4 | 23 | 36 | 45.23 | 3 | 44 | 53.1 | 29.576 017 | 0.30 | 1.13 | 4 | 47 | 04 |
| | 5 | 23 | 36 | 44.26 | 3 | 45 | 02.3 | 29.560 157 | 0.30 | 1.13 | 4 | 43 | 07 |
| | 6 | 23 | 36 | 43.18 | 3 | 45 | 12.2 | 29.544 394 | 0.30 | 1.13 | 4 | 39 | 10 |
| | 7 | 23 | 36 | 41.98 | -3 | 45 | 22.9 | 29.528 733 | 0.30 | 1.13 | 4 | 35 | 13 |
| | 8 | 23 | 36 | 40.67 | 3 | 45 | 34.3 | 29.513 178 | 0.30 | 1.14 | 4 | 31 | 16 |
| | 9 | 23 | 36 | 39.24 | 3 | 45 | 46.4 | 29.497 735 | 0.30 | 1.14 | 4 | 27 | 19 |
| | 10 | 23 | 36 | 37.70 | 3 | 45 | 59.2 | 29.482 408 | 0.30 | 1.14 | 4 | 23 | 21 |
| | 11 | 23 | 36 | 36.05 | 3 | 46 | 12.8 | 29.467 202 | 0.30 | 1.14 | 4 | 19 | 23 |
| | 12 | 23 | 36 | 34.27 | 3 | 46 | 27.1 | 29.452 123 | 0.30 | 1.14 | 4 | 15 | 26 |
| | 13 | 23 | 36 | 32.39 | -3 | 46 | 42.1 | 29.437 173 | 0.30 | 1.14 | 4 | 11 | 28 |
| | 14 | 23 | 36 | 30.38 | 3 | 46 | 57.8 | 29.422 359 | 0.30 | 1.14 | 4 | 07 | 30 |
| | 15 | 23 | 36 | 28.27 | 3 | 47 | 14.3 | 29.407 684 | 0.30 | 1.14 | 4 | 03 | 32 |
| | 16 | 23 | 36 | 26.04 | 3 | 47 | 31.5 | 29.393 153 | 0.30 | 1.14 | 3 | 59 | 34 |
| | 17 | 23 | 36 | 23.70 | 3 | 47 | 49.3 | 29.378 770 | 0.30 | 1.14 | 3 | 55 | 36 |
| | 18 | 23 | 36 | 21.26 | 3 | 48 | 07.8 | 29.364 539 | 0.30 | 1.14 | 3 | 51 | 37 |
| | 19 | 23 | 36 | 18.71 | -3 | 48 | 27.0 | 29.350 465 | 0.30 | 1.14 | 3 | 47 | 39 |
| | 20 | 23 | 36 | 16.07 | 3 | 48 | 46.7 | 29.336 551 | 0.30 | 1.14 | 3 | 43 | 40 |
| | 21 | 23 | 36 | 13.32 | 3 | 49 | 07.2 | 29.322 801 | 0.30 | 1.14 | 3 | 39 | 42 |
| | 22 | 23 | 36 | 10.47 | 3 | 49 | 28.2 | 29.309 219 | 0.30 | 1.14 | 3 | 35 | 43 |
| | 23 | 23 | 36 | 07.51 | 3 | 49 | 49.9 | 29.295 808 | 0.30 | 1.14 | 3 | 31 | 44 |
| | 24 | 23 | 36 | 04.46 | 3 | 50 | 12.2 | 29.282 572 | 0.30 | 1.14 | 3 | 27 | 45 |
| | 25 | 23 | 36 | 01.30 | -3 | 50 | 35.2 | 29.269 514 | 0.30 | 1.14 | 3 | 23 | 46 |
| | 26 | 23 | 35 | 58.04 | 3 | 50 | 58.8 | 29.256 637 | 0.30 | 1.15 | 3 | 19 | 47 |
| | 27 | 23 | 35 | 54.67 | 3 | 51 | 23.0 | 29.243 947 | 0.30 | 1.15 | 3 | 15 | 47 |
| | 28 | 23 | 35 | 51.21 | 3 | 51 | 47.9 | 29.231 446 | 0.30 | 1.15 | 3 | 11 | 48 |
| | 29 | 23 | 35 | 47.65 | 3 | 52 | 13.3 | 29.219 139 | 0.30 | 1.15 | 3 | 07 | 49 |
| | 30 | 23 | 35 | 43.99 | 3 | 52 | 39.3 | 29.207 028 | 0.30 | 1.15 | 3 | 03 | 49 |
| | 31 | 23 | 35 | 40.25 | -3 | 53 | 05.9 | 29.195 118 | 0.30 | 1.15 | 2 | 59 | 49 |
| Aug. | 1 | 23 | 35 | 36.41 | 3 | 53 | 33.0 | 29.183 413 | 0.30 | 1.15 | 2 | 55 | 50 |
| | 2 | 23 | 35 | 32.48 | 3 | 54 | 00.7 | 29.171 917 | 0.30 | 1.15 | 2 | 51 | 50 |
| | 3 | 23 | 35 | 28.47 | 3 | 54 | 28.9 | 29.160 633 | 0.30 | 1.15 | 2 | 47 | 50 |
| | 4 | 23 | 35 | 24.37 | 3 | 54 | 57.6 | 29.149 565 | 0.30 | 1.15 | 2 | 43 | 50 |
| | 5 | 23 | 35 | 20.18 | 3 | 55 | 26.9 | 29.138 717 | 0.30 | 1.15 | 2 | 39 | 50 |
| | 6 | 23 | 35 | 15.91 | -3 | 55 | 56.6 | 29.128 093 | 0.30 | 1.15 | 2 | 35 | 50 |
| | 7 | 23 | 35 | 11.55 | 3 | 56 | 26.9 | 29.117 696 | 0.30 | 1.15 | 2 | 31 | 49 |
| | 8 | 23 | 35 | 07.12 | 3 | 56 | 57.7 | 29.107 529 | 0.30 | 1.15 | 2 | 27 | 49 |
| | 9 | 23 | 35 | 02.59 | 3 | 57 | 28.9 | 29.097 597 | 0.30 | 1.15 | 2 | 23 | 49 |
| | 10 | 23 | 34 | 57.99 | 3 | 58 | 00.7 | 29.087 903 | 0.30 | 1.15 | 2 | 19 | 48 |
| | 11 | 23 | 34 | 53.31 | 3 | 58 | 32.9 | 29.078 449 | 0.30 | 1.15 | 2 | 15 | 48 |
| | 12 | 23 | 34 | 48.55 | -3 | 59 | 05.6 | 29.069 239 | 0.30 | 1.15 | 2 | 11 | 47 |
| | 13 | 23 | 34 | 43.72 | 3 | 59 | 38.8 | 29.060 276 | 0.30 | 1.15 | 2 | 07 | 46 |
| | 14 | 23 | 34 | 38.82 | 4 | 00 | 12.3 | 29.051 563 | 0.30 | 1.15 | 2 | 03 | 46 |
| | 15 | 23 | 34 | 33.85 | 4 | 00 | 46.2 | 29.043 103 | 0.30 | 1.15 | 1 | 59 | 45 |
| | 16 | 23 | 34 | 28.82 | -4 | 01 | 20.5 | 29.034 896 | 0.30 | 1.15 | 1 | 55 | 44 |

**NEPTUNE, 2021**
RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Aug. | 16 | 23 | 34 | 28.82 | -4 | 01 | 20.5 | 29.034 896 | 0.30 | 1.15 | 1 | 55 | 44 |
| | 17 | 23 | 34 | 23.73 | 4 | 01 | 55.1 | 29.026 947 | 0.30 | 1.15 | 1 | 51 | 43 |
| | 18 | 23 | 34 | 18.57 | 4 | 02 | 30.1 | 29.019 258 | 0.30 | 1.15 | 1 | 47 | 42 |
| | 19 | 23 | 34 | 13.36 | 4 | 03 | 05.4 | 29.011 829 | 0.30 | 1.15 | 1 | 43 | 41 |
| | 20 | 23 | 34 | 08.09 | 4 | 03 | 41.1 | 29.004 664 | 0.30 | 1.15 | 1 | 39 | 39 |
| | 21 | 23 | 34 | 02.76 | 4 | 04 | 17.1 | 28.997 764 | 0.30 | 1.16 | 1 | 35 | 38 |
| | 22 | 23 | 33 | 57.37 | -4 | 04 | 53.4 | 28.991 131 | 0.30 | 1.16 | 1 | 31 | 37 |
| | 23 | 23 | 33 | 51.92 | 4 | 05 | 30.1 | 28.984 768 | 0.30 | 1.16 | 1 | 27 | 36 |
| | 24 | 23 | 33 | 46.41 | 4 | 06 | 07.1 | 28.978 676 | 0.30 | 1.16 | 1 | 23 | 34 |
| | 25 | 23 | 33 | 40.86 | 4 | 06 | 44.4 | 28.972 857 | 0.30 | 1.16 | 1 | 19 | 33 |
| | 26 | 23 | 33 | 35.26 | 4 | 07 | 21.9 | 28.967 313 | 0.30 | 1.16 | 1 | 15 | 31 |
| | 27 | 23 | 33 | 29.61 | 4 | 07 | 59.6 | 28.962 047 | 0.30 | 1.16 | 1 | 11 | 30 |
| | 28 | 23 | 33 | 23.92 | -4 | 08 | 37.6 | 28.957 060 | 0.30 | 1.16 | 1 | 07 | 28 |
| | 29 | 23 | 33 | 18.19 | 4 | 09 | 15.8 | 28.952 355 | 0.30 | 1.16 | 1 | 03 | 27 |
| | 30 | 23 | 33 | 12.43 | 4 | 09 | 54.2 | 28.947 933 | 0.30 | 1.16 | 0 | 59 | 25 |
| | 31 | 23 | 33 | 06.62 | 4 | 10 | 32.8 | 28.943 796 | 0.30 | 1.16 | 0 | 55 | 23 |
| Sept. | 1 | 23 | 33 | 00.79 | 4 | 11 | 11.5 | 28.939 946 | 0.30 | 1.16 | 0 | 51 | 22 |
| | 2 | 23 | 32 | 54.92 | 4 | 11 | 50.4 | 28.936 384 | 0.30 | 1.16 | 0 | 47 | 20 |
| | 3 | 23 | 32 | 49.02 | -4 | 12 | 29.4 | 28.933 113 | 0.30 | 1.16 | 0 | 43 | 18 |
| | 4 | 23 | 32 | 43.10 | 4 | 13 | 08.6 | 28.930 134 | 0.30 | 1.16 | 0 | 39 | 16 |
| | 5 | 23 | 32 | 37.14 | 4 | 13 | 48.0 | 28.927 448 | 0.30 | 1.16 | 0 | 35 | 14 |
| | 6 | 23 | 32 | 31.15 | 4 | 14 | 27.4 | 28.925 056 | 0.30 | 1.16 | 0 | 31 | 13 |
| | 7 | 23 | 32 | 25.15 | 4 | 15 | 07.0 | 28.922 961 | 0.30 | 1.16 | 0 | 27 | 11 |
| | 8 | 23 | 32 | 19.12 | 4 | 15 | 46.7 | 28.921 162 | 0.30 | 1.16 | 0 | 23 | 09 |
| | 9 | 23 | 32 | 13.07 | -4 | 16 | 26.4 | 28.919 661 | 0.30 | 1.16 | 0 | 19 | 07 |
| | 10 | 23 | 32 | 07.01 | 4 | 17 | 06.1 | 28.918 457 | 0.30 | 1.16 | 0 | 15 | 05 |
| | 11 | 23 | 32 | 00.94 | 4 | 17 | 45.9 | 28.917 553 | 0.30 | 1.16 | 0 | 11 | 03 |
| | 12 | 23 | 31 | 54.87 | 4 | 18 | 25.6 | 28.916 947 | 0.30 | 1.16 | 0 | 07 | 01 |
| | 13 | 23 | 31 | 48.79 | 4 | 19 | 05.3 | 28.916 641 | 0.30 | 1.16 | 0 | 02 | 59 |
| | 14 | 23 | 31 | 42.71 | 4 | 19 | 44.9 | 28.916 633 | 0.30 | 1.16 | 23 | 54 | 55 |
| | 15 | 23 | 31 | 36.64 | -4 | 20 | 24.5 | 28.916 924 | 0.30 | 1.16 | 23 | 50 | 53 |
| | 16 | 23 | 31 | 30.56 | 4 | 21 | 04.1 | 28.917 513 | 0.30 | 1.16 | 23 | 46 | 51 |
| | 17 | 23 | 31 | 24.48 | 4 | 21 | 43.6 | 28.918 401 | 0.30 | 1.16 | 23 | 42 | 49 |
| | 18 | 23 | 31 | 18.41 | 4 | 22 | 23.1 | 28.919 586 | 0.30 | 1.16 | 23 | 38 | 47 |
| | 19 | 23 | 31 | 12.33 | 4 | 23 | 02.4 | 28.921 068 | 0.30 | 1.16 | 23 | 34 | 45 |
| | 20 | 23 | 31 | 06.27 | 4 | 23 | 41.7 | 28.922 847 | 0.30 | 1.16 | 23 | 30 | 44 |
| | 21 | 23 | 31 | 00.21 | -4 | 24 | 20.9 | 28.924 923 | 0.30 | 1.16 | 23 | 26 | 42 |
| | 22 | 23 | 30 | 54.17 | 4 | 24 | 59.9 | 28.927 295 | 0.30 | 1.16 | 23 | 22 | 40 |
| | 23 | 23 | 30 | 48.15 | 4 | 25 | 38.8 | 28.929 963 | 0.30 | 1.16 | 23 | 18 | 38 |
| | 24 | 23 | 30 | 42.14 | 4 | 26 | 17.4 | 28.932 926 | 0.30 | 1.16 | 23 | 14 | 36 |
| | 25 | 23 | 30 | 36.16 | 4 | 26 | 55.9 | 28.936 183 | 0.30 | 1.16 | 23 | 10 | 34 |
| | 26 | 23 | 30 | 30.20 | 4 | 27 | 34.2 | 28.939 735 | 0.30 | 1.16 | 23 | 06 | 32 |
| | 27 | 23 | 30 | 24.27 | -4 | 28 | 12.2 | 28.943 581 | 0.30 | 1.16 | 23 | 02 | 31 |
| | 28 | 23 | 30 | 18.37 | 4 | 28 | 50.0 | 28.947 720 | 0.30 | 1.16 | 22 | 58 | 29 |
| | 29 | 23 | 30 | 12.51 | 4 | 29 | 27.5 | 28.952 151 | 0.30 | 1.16 | 22 | 54 | 27 |
| | 30 | 23 | 30 | 06.67 | 4 | 30 | 04.8 | 28.956 873 | 0.30 | 1.16 | 22 | 50 | 25 |
| Oct. | 1 | 23 | 30 | 00.87 | -4 | 30 | 41.9 | 28.961 886 | 0.30 | 1.16 | 22 | 46 | 24 |

**NEPTUNE, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Oct. | 1 | 23 | 30 | 00.87 | -4 | 30 | 41.9 | 28.961 886 | 0.30 | 1.16 | 22 | 46 | 24 |
| | 2 | 23 | 29 | 55.10 | 4 | 31 | 18.6 | 28.967 187 | 0.30 | 1.16 | 22 | 42 | 22 |
| | 3 | 23 | 29 | 49.37 | 4 | 31 | 55.1 | 28.972 777 | 0.30 | 1.16 | 22 | 38 | 21 |
| | 4 | 23 | 29 | 43.68 | 4 | 32 | 31.3 | 28.978 654 | 0.30 | 1.16 | 22 | 34 | 19 |
| | 5 | 23 | 29 | 38.03 | 4 | 33 | 07.2 | 28.984 816 | 0.30 | 1.16 | 22 | 30 | 18 |
| | 6 | 23 | 29 | 32.43 | 4 | 33 | 42.7 | 28.991 262 | 0.30 | 1.16 | 22 | 26 | 16 |
| | 7 | 23 | 29 | 26.87 | -4 | 34 | 17.8 | 28.997 989 | 0.30 | 1.16 | 22 | 22 | 15 |
| | 8 | 23 | 29 | 21.37 | 4 | 34 | 52.6 | 29.004 997 | 0.30 | 1.15 | 22 | 18 | 13 |
| | 9 | 23 | 29 | 15.93 | 4 | 35 | 26.9 | 29.012 281 | 0.30 | 1.15 | 22 | 14 | 12 |
| | 10 | 23 | 29 | 10.55 | 4 | 36 | 00.9 | 29.019 841 | 0.30 | 1.15 | 22 | 10 | 11 |
| | 11 | 23 | 29 | 05.23 | 4 | 36 | 34.3 | 29.027 673 | 0.30 | 1.15 | 22 | 06 | 10 |
| | 12 | 23 | 28 | 59.97 | 4 | 37 | 07.3 | 29.035 774 | 0.30 | 1.15 | 22 | 02 | 09 |
| | 13 | 23 | 28 | 54.77 | -4 | 37 | 39.9 | 29.044 142 | 0.30 | 1.15 | 21 | 58 | 08 |
| | 14 | 23 | 28 | 49.64 | 4 | 38 | 12.1 | 29.052 775 | 0.30 | 1.15 | 21 | 54 | 07 |
| | 15 | 23 | 28 | 44.57 | 4 | 38 | 43.8 | 29.061 668 | 0.30 | 1.15 | 21 | 50 | 06 |
| | 16 | 23 | 28 | 39.57 | 4 | 39 | 15.0 | 29.070 819 | 0.30 | 1.15 | 21 | 46 | 05 |
| | 17 | 23 | 28 | 34.63 | 4 | 39 | 45.7 | 29.080 226 | 0.30 | 1.15 | 21 | 42 | 04 |
| | 18 | 23 | 28 | 29.77 | 4 | 40 | 16.0 | 29.089 885 | 0.30 | 1.15 | 21 | 38 | 04 |
| | 19 | 23 | 28 | 24.97 | -4 | 40 | 45.7 | 29.099 794 | 0.30 | 1.15 | 21 | 34 | 03 |
| | 20 | 23 | 28 | 20.26 | 4 | 41 | 14.9 | 29.109 949 | 0.30 | 1.15 | 21 | 30 | 03 |
| | 21 | 23 | 28 | 15.62 | 4 | 41 | 43.6 | 29.120 348 | 0.30 | 1.15 | 21 | 26 | 02 |
| | 22 | 23 | 28 | 11.07 | 4 | 42 | 11.7 | 29.130 988 | 0.30 | 1.15 | 21 | 22 | 02 |
| | 23 | 23 | 28 | 06.60 | 4 | 42 | 39.2 | 29.141 865 | 0.30 | 1.15 | 21 | 18 | 01 |
| | 24 | 23 | 28 | 02.21 | 4 | 43 | 06.1 | 29.152 978 | 0.30 | 1.15 | 21 | 14 | 01 |
| | 25 | 23 | 27 | 57.91 | -4 | 43 | 32.4 | 29.164 322 | 0.30 | 1.15 | 21 | 10 | 01 |
| | 26 | 23 | 27 | 53.70 | 4 | 43 | 58.2 | 29.175 895 | 0.30 | 1.15 | 21 | 06 | 01 |
| | 27 | 23 | 27 | 49.58 | 4 | 44 | 23.3 | 29.187 693 | 0.30 | 1.15 | 21 | 02 | 01 |
| | 28 | 23 | 27 | 45.55 | 4 | 44 | 47.8 | 29.199 713 | 0.30 | 1.15 | 20 | 58 | 01 |
| | 29 | 23 | 27 | 41.61 | 4 | 45 | 11.7 | 29.211 952 | 0.30 | 1.15 | 20 | 54 | 02 |
| | 30 | 23 | 27 | 37.76 | 4 | 45 | 35.0 | 29.224 406 | 0.30 | 1.15 | 20 | 50 | 02 |
| | 31 | 23 | 27 | 34.01 | -4 | 45 | 57.7 | 29.237 072 | 0.30 | 1.15 | 20 | 46 | 02 |
| Nov. | 1 | 23 | 27 | 30.35 | 4 | 46 | 19.7 | 29.249 945 | 0.30 | 1.15 | 20 | 42 | 03 |
| | 2 | 23 | 27 | 26.78 | 4 | 46 | 41.0 | 29.263 023 | 0.30 | 1.14 | 20 | 38 | 04 |
| | 3 | 23 | 27 | 23.32 | 4 | 47 | 01.7 | 29.276 300 | 0.30 | 1.14 | 20 | 34 | 04 |
| | 4 | 23 | 27 | 19.96 | 4 | 47 | 21.7 | 29.289 774 | 0.30 | 1.14 | 20 | 30 | 05 |
| | 5 | 23 | 27 | 16.71 | 4 | 47 | 41.0 | 29.303 439 | 0.30 | 1.14 | 20 | 26 | 06 |
| | 6 | 23 | 27 | 13.57 | -4 | 47 | 59.5 | 29.317 291 | 0.30 | 1.14 | 20 | 22 | 07 |
| | 7 | 23 | 27 | 10.54 | 4 | 48 | 17.3 | 29.331 326 | 0.30 | 1.14 | 20 | 18 | 08 |
| | 8 | 23 | 27 | 07.62 | 4 | 48 | 34.4 | 29.345 538 | 0.30 | 1.14 | 20 | 14 | 10 |
| | 9 | 23 | 27 | 04.81 | 4 | 48 | 50.7 | 29.359 922 | 0.30 | 1.14 | 20 | 10 | 11 |
| | 10 | 23 | 27 | 02.11 | 4 | 49 | 06.3 | 29.374 474 | 0.30 | 1.14 | 20 | 06 | 12 |
| | 11 | 23 | 26 | 59.52 | 4 | 49 | 21.2 | 29.389 190 | 0.30 | 1.14 | 20 | 02 | 14 |
| | 12 | 23 | 26 | 57.03 | -4 | 49 | 35.4 | 29.404 063 | 0.30 | 1.14 | 19 | 58 | 16 |
| | 13 | 23 | 26 | 54.66 | 4 | 49 | 48.8 | 29.419 089 | 0.30 | 1.14 | 19 | 54 | 18 |
| | 14 | 23 | 26 | 52.40 | 4 | 50 | 01.5 | 29.434 264 | 0.30 | 1.14 | 19 | 50 | 20 |
| | 15 | 23 | 26 | 50.26 | 4 | 50 | 13.4 | 29.449 583 | 0.30 | 1.14 | 19 | 46 | 22 |
| | 16 | 23 | 26 | 48.23 | -4 | 50 | 24.6 | 29.465 041 | 0.30 | 1.14 | 19 | 42 | 24 |

**NEPTUNE, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Apparent Declination | | | True Distance from the Earth | Hor. Parallax | Semi Diameter | Ephemeris Transit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | ° | ' | " | | " | " | h | m | s |
| Nov. | 16 | 23 | 26 | 48.23 | -4 | 50 | 24.6 | 29.465 041 | 0.30 | 1.14 | 19 | 42 | 24 |
| | 17 | 23 | 26 | 46.32 | 4 | 50 | 35.0 | 29.480 633 | 0.30 | 1.14 | 19 | 38 | 26 |
| | 18 | 23 | 26 | 44.54 | 4 | 50 | 44.5 | 29.496 355 | 0.30 | 1.14 | 19 | 34 | 28 |
| | 19 | 23 | 26 | 42.87 | 4 | 50 | 53.3 | 29.512 202 | 0.30 | 1.14 | 19 | 30 | 31 |
| | 20 | 23 | 26 | 41.32 | 4 | 51 | 01.3 | 29.528 170 | 0.30 | 1.13 | 19 | 26 | 34 |
| | 21 | 23 | 26 | 39.90 | 4 | 51 | 08.5 | 29.544 254 | 0.30 | 1.13 | 19 | 22 | 36 |
| | 22 | 23 | 26 | 38.60 | -4 | 51 | 14.9 | 29.560 449 | 0.30 | 1.13 | 19 | 18 | 39 |
| | 23 | 23 | 26 | 37.43 | 4 | 51 | 20.5 | 29.576 751 | 0.30 | 1.13 | 19 | 14 | 42 |
| | 24 | 23 | 26 | 36.38 | 4 | 51 | 25.3 | 29.593 154 | 0.30 | 1.13 | 19 | 10 | 45 |
| | 25 | 23 | 26 | 35.44 | 4 | 51 | 29.3 | 29.609 654 | 0.30 | 1.13 | 19 | 06 | 49 |
| | 26 | 23 | 26 | 34.64 | 4 | 51 | 32.5 | 29.626 246 | 0.30 | 1.13 | 19 | 02 | 52 |
| | 27 | 23 | 26 | 33.95 | 4 | 51 | 34.9 | 29.642 925 | 0.30 | 1.13 | 18 | 58 | 56 |
| | 28 | 23 | 26 | 33.39 | -4 | 51 | 36.5 | 29.659 687 | 0.30 | 1.13 | 18 | 54 | 59 |
| | 29 | 23 | 26 | 32.95 | 4 | 51 | 37.4 | 29.676 525 | 0.30 | 1.13 | 18 | 51 | 03 |
| | 30 | 23 | 26 | 32.63 | 4 | 51 | 37.4 | 29.693 436 | 0.30 | 1.13 | 18 | 47 | 07 |
| Dec. | 1 | 23 | 26 | 32.45 | 4 | 51 | 36.5 | 29.710 413 | 0.30 | 1.13 | 18 | 43 | 11 |
| | 2 | 23 | 26 | 32.39 | 4 | 51 | 34.9 | 29.727 452 | 0.30 | 1.13 | 18 | 39 | 15 |
| | 3 | 23 | 26 | 32.46 | 4 | 51 | 32.4 | 29.744 546 | 0.30 | 1.13 | 18 | 35 | 19 |
| | 4 | 23 | 26 | 32.67 | -4 | 51 | 29.0 | 29.761 690 | 0.30 | 1.13 | 18 | 31 | 24 |
| | 5 | 23 | 26 | 33.01 | 4 | 51 | 24.8 | 29.778 879 | 0.30 | 1.12 | 18 | 27 | 28 |
| | 6 | 23 | 26 | 33.49 | 4 | 51 | 19.7 | 29.796 106 | 0.30 | 1.12 | 18 | 23 | 33 |
| | 7 | 23 | 26 | 34.09 | 4 | 51 | 13.8 | 29.813 366 | 0.29 | 1.12 | 18 | 19 | 38 |
| | 8 | 23 | 26 | 34.81 | 4 | 51 | 07.1 | 29.830 654 | 0.29 | 1.12 | 18 | 15 | 42 |
| | 9 | 23 | 26 | 35.66 | 4 | 50 | 59.7 | 29.847 962 | 0.29 | 1.12 | 18 | 11 | 48 |
| | 10 | 23 | 26 | 36.64 | -4 | 50 | 51.4 | 29.865 286 | 0.29 | 1.12 | 18 | 07 | 53 |
| | 11 | 23 | 26 | 37.74 | 4 | 50 | 42.3 | 29.882 621 | 0.29 | 1.12 | 18 | 03 | 58 |
| | 12 | 23 | 26 | 38.97 | 4 | 50 | 32.4 | 29.899 961 | 0.29 | 1.12 | 18 | 00 | 03 |
| | 13 | 23 | 26 | 40.32 | 4 | 50 | 21.7 | 29.917 301 | 0.29 | 1.12 | 17 | 56 | 09 |
| | 14 | 23 | 26 | 41.80 | 4 | 50 | 10.1 | 29.934 635 | 0.29 | 1.12 | 17 | 52 | 15 |
| | 15 | 23 | 26 | 43.42 | 4 | 49 | 57.8 | 29.951 959 | 0.29 | 1.12 | 17 | 48 | 20 |
| | 16 | 23 | 26 | 45.16 | -4 | 49 | 44.6 | 29.969 267 | 0.29 | 1.12 | 17 | 44 | 26 |
| | 17 | 23 | 26 | 47.03 | 4 | 49 | 30.6 | 29.986 555 | 0.29 | 1.12 | 17 | 40 | 32 |
| | 18 | 23 | 26 | 49.03 | 4 | 49 | 15.7 | 30.003 818 | 0.29 | 1.12 | 17 | 36 | 38 |
| | 19 | 23 | 26 | 51.15 | 4 | 49 | 00.1 | 30.021 049 | 0.29 | 1.12 | 17 | 32 | 45 |
| | 20 | 23 | 26 | 53.41 | 4 | 48 | 43.7 | 30.038 246 | 0.29 | 1.12 | 17 | 28 | 51 |
| | 21 | 23 | 26 | 55.78 | 4 | 48 | 26.5 | 30.055 402 | 0.29 | 1.11 | 17 | 24 | 58 |
| | 22 | 23 | 26 | 58.28 | -4 | 48 | 08.5 | 30.072 512 | 0.29 | 1.11 | 17 | 21 | 04 |
| | 23 | 23 | 27 | 00.90 | 4 | 47 | 49.7 | 30.089 573 | 0.29 | 1.11 | 17 | 17 | 11 |
| | 24 | 23 | 27 | 03.65 | 4 | 47 | 30.2 | 30.106 578 | 0.29 | 1.11 | 17 | 13 | 18 |
| | 25 | 23 | 27 | 06.51 | 4 | 47 | 09.9 | 30.123 523 | 0.29 | 1.11 | 17 | 09 | 25 |
| | 26 | 23 | 27 | 09.49 | 4 | 46 | 48.9 | 30.140 403 | 0.29 | 1.11 | 17 | 05 | 32 |
| | 27 | 23 | 27 | 12.60 | 4 | 46 | 27.1 | 30.157 213 | 0.29 | 1.11 | 17 | 01 | 40 |
| | 28 | 23 | 27 | 15.82 | -4 | 46 | 04.5 | 30.173 948 | 0.29 | 1.11 | 16 | 57 | 47 |
| | 29 | 23 | 27 | 19.17 | 4 | 45 | 41.1 | 30.190 603 | 0.29 | 1.11 | 16 | 53 | 54 |
| | 30 | 23 | 27 | 22.64 | 4 | 45 | 17.0 | 30.207 172 | 0.29 | 1.11 | 16 | 50 | 02 |
| | 31 | 23 | 27 | 26.24 | 4 | 44 | 52.1 | 30.223 651 | 0.29 | 1.11 | 16 | 46 | 10 |
| | 32 | 23 | 27 | 29.96 | -4 | 44 | 26.4 | 30.240 033 | 0.29 | 1.11 | 16 | 42 | 18 |

**PLUTO, 2021**

HELIOCENTRIC POSITIONS FOR $0^h$ TERRESTRIAL TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

| Date | Heliocentric Longitude | | | Heliocentric Latitude | | | Radius Vector | Date | Heliocentric Longitude | | | Heliocentric Latitude | | | Radius Vector |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ° | ′ | ″ | ° | ′ | ″ | | | ° | ′ | ″ | ° | ′ | ″ | |
| Jan. 1 | 294 | 34 | 53.2 | -1 | 13 | 44.1 | 34.191 69 | July 5 | 295 | 29 | 46.4 | -1 | 30 | 26.0 | 34.314 23 |
| 6 | 294 | 36 | 22.5 | 1 | 14 | 11.3 | 34.195 00 | 10 | 295 | 31 | 15.1 | 1 | 30 | 52.9 | 34.317 54 |
| 11 | 294 | 37 | 51.8 | 1 | 14 | 38.5 | 34.198 31 | 15 | 295 | 32 | 43.8 | 1 | 31 | 19.9 | 34.320 86 |
| 16 | 294 | 39 | 21.1 | 1 | 15 | 05.7 | 34.201 62 | 20 | 295 | 34 | 12.4 | 1 | 31 | 46.8 | 34.324 18 |
| 21 | 294 | 40 | 50.3 | 1 | 15 | 32.8 | 34.204 92 | 25 | 295 | 35 | 41.1 | 1 | 32 | 13.8 | 34.327 50 |
| 26 | 294 | 42 | 19.6 | 1 | 15 | 60.0 | 34.208 23 | 30 | 295 | 37 | 09.7 | 1 | 32 | 40.7 | 34.330 81 |
| 31 | 294 | 43 | 48.8 | -1 | 16 | 27.1 | 34.211 54 | Aug. 4 | 295 | 38 | 38.3 | -1 | 33 | 07.6 | 34.334 13 |
| Feb. 5 | 294 | 45 | 18.0 | 1 | 16 | 54.3 | 34.214 85 | 9 | 295 | 40 | 06.8 | 1 | 33 | 34.6 | 34.337 45 |
| 10 | 294 | 46 | 47.2 | 1 | 17 | 21.4 | 34.218 16 | 14 | 295 | 41 | 35.4 | 1 | 34 | 01.5 | 34.340 77 |
| 15 | 294 | 48 | 16.4 | 1 | 17 | 48.6 | 34.221 47 | 19 | 295 | 43 | 04.0 | 1 | 34 | 28.4 | 34.344 09 |
| 20 | 294 | 49 | 45.5 | 1 | 18 | 15.7 | 34.224 77 | 24 | 295 | 44 | 32.5 | 1 | 34 | 55.3 | 34.347 41 |
| 25 | 294 | 51 | 14.7 | 1 | 18 | 42.8 | 34.228 08 | 29 | 295 | 46 | 01.0 | 1 | 35 | 22.2 | 34.350 73 |
| Mar. 2 | 294 | 52 | 43.8 | -1 | 19 | 09.9 | 34.231 39 | Sept. 3 | 295 | 47 | 29.5 | -1 | 35 | 49.1 | 34.354 05 |
| 7 | 294 | 54 | 12.9 | 1 | 19 | 37.1 | 34.234 70 | 8 | 295 | 48 | 58.0 | 1 | 36 | 16.0 | 34.357 37 |
| 12 | 294 | 55 | 42.0 | 1 | 20 | 04.2 | 34.238 01 | 13 | 295 | 50 | 26.4 | 1 | 36 | 42.8 | 34.360 69 |
| 17 | 294 | 57 | 11.1 | 1 | 20 | 31.3 | 34.241 32 | 18 | 295 | 51 | 54.8 | 1 | 37 | 09.7 | 34.364 01 |
| 22 | 294 | 58 | 40.2 | 1 | 20 | 58.4 | 34.244 64 | 23 | 295 | 53 | 23.3 | 1 | 37 | 36.6 | 34.367 33 |
| 27 | 295 | 00 | 09.2 | 1 | 21 | 25.5 | 34.247 95 | 28 | 295 | 54 | 51.7 | 1 | 38 | 03.4 | 34.370 65 |
| Apr. 1 | 295 | 01 | 38.2 | -1 | 21 | 52.5 | 34.251 26 | Oct. 3 | 295 | 56 | 20.1 | -1 | 38 | 30.3 | 34.373 97 |
| 6 | 295 | 03 | 07.2 | 1 | 22 | 19.6 | 34.254 57 | 8 | 295 | 57 | 48.5 | 1 | 38 | 57.2 | 34.377 29 |
| 11 | 295 | 04 | 36.2 | 1 | 22 | 46.7 | 34.257 88 | 13 | 295 | 59 | 16.8 | 1 | 39 | 24.0 | 34.380 61 |
| 16 | 295 | 06 | 05.2 | 1 | 23 | 13.8 | 34.261 19 | 18 | 296 | 00 | 45.2 | 1 | 39 | 50.8 | 34.383 93 |
| 21 | 295 | 07 | 34.1 | 1 | 23 | 40.8 | 34.264 51 | 23 | 296 | 02 | 13.5 | 1 | 40 | 17.7 | 34.387 25 |
| 26 | 295 | 09 | 03.1 | 1 | 24 | 07.9 | 34.267 82 | 28 | 296 | 03 | 41.8 | 1 | 40 | 44.5 | 34.390 58 |
| May 1 | 295 | 10 | 32.0 | -1 | 24 | 34.9 | 34.271 13 | Nov. 2 | 296 | 05 | 10.1 | -1 | 41 | 11.3 | 34.393 90 |
| 6 | 295 | 12 | 00.9 | 1 | 25 | 02.0 | 34.274 44 | 7 | 296 | 06 | 38.3 | 1 | 41 | 38.1 | 34.397 22 |
| 11 | 295 | 13 | 29.8 | 1 | 25 | 29.0 | 34.277 76 | 12 | 296 | 08 | 06.6 | 1 | 42 | 04.9 | 34.400 54 |
| 16 | 295 | 14 | 58.7 | 1 | 25 | 56.0 | 34.281 07 | 17 | 296 | 09 | 34.8 | 1 | 42 | 31.7 | 34.403 87 |
| 21 | 295 | 16 | 27.5 | 1 | 26 | 23.0 | 34.284 39 | 22 | 296 | 11 | 03.0 | 1 | 42 | 58.5 | 34.407 19 |
| 26 | 295 | 17 | 56.4 | 1 | 26 | 50.0 | 34.287 70 | 27 | 296 | 12 | 31.2 | 1 | 43 | 25.3 | 34.410 51 |
| 31 | 295 | 19 | 25.2 | -1 | 27 | 17.0 | 34.291 02 | Dec. 2 | 296 | 13 | 59.4 | -1 | 43 | 52.1 | 34.413 84 |
| June 5 | 295 | 20 | 54.0 | 1 | 27 | 44.1 | 34.294 33 | 7 | 296 | 15 | 27.6 | 1 | 44 | 18.8 | 34.417 16 |
| 10 | 295 | 22 | 22.7 | 1 | 28 | 11.1 | 34.297 65 | 12 | 296 | 16 | 55.7 | 1 | 44 | 45.6 | 34.420 49 |
| 15 | 295 | 23 | 51.5 | 1 | 28 | 38.1 | 34.300 96 | 17 | 296 | 18 | 23.8 | 1 | 45 | 12.4 | 34.423 81 |
| 20 | 295 | 25 | 20.3 | 1 | 29 | 05.0 | 34.304 28 | 22 | 296 | 19 | 51.9 | 1 | 45 | 39.1 | 34.427 14 |
| 25 | 295 | 26 | 49.0 | 1 | 29 | 32.0 | 34.307 59 | 27 | 296 | 21 | 20.0 | 1 | 46 | 05.9 | 34.430 46 |
| 30 | 295 | 28 | 17.7 | -1 | 29 | 59.0 | 34.310 91 | 32 | 296 | 22 | 48.1 | -1 | 46 | 32.6 | 34.433 79 |
| July 5 | 295 | 29 | 46.4 | -1 | 30 | 26.0 | 34.314 23 | 37 | 296 | 24 | 16.2 | -1 | 46 | 59.3 | 34.437 11 |

N.B: Pluto is now classified as a dwarf planet as per resolution of IAU

**PLUTO, 2021**

GEOCENTRIC LONGITUDE AND LATITUDE FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | | Date | | Apparent Geocentric Longitude | | | Apparent Geocentric Latitude | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " |
| Jan. | 1 | 294 | 11 | 17.2 | -1 | 11 | 42.8 | July | 5 | 295 | 52 | 06.0 | -1 | 33 | 06.4 |
| | 6 | 294 | 21 | 07.5 | 1 | 12 | 07.2 | | 10 | 295 | 45 | 02.3 | 1 | 33 | 36.7 |
| | 11 | 294 | 31 | 04.5 | 1 | 12 | 32.5 | | 15 | 295 | 37 | 51.9 | 1 | 34 | 05.8 |
| | 16 | 294 | 41 | 04.2 | 1 | 12 | 58.8 | | 20 | 295 | 30 | 39.1 | 1 | 34 | 33.6 |
| | 21 | 294 | 51 | 02.3 | 1 | 13 | 25.7 | | 25 | 295 | 23 | 28.8 | 1 | 35 | 00.3 |
| | 26 | 295 | 00 | 56.2 | 1 | 13 | 53.7 | | 30 | 295 | 16 | 23.1 | 1 | 35 | 25.6 |
| | 31 | 295 | 10 | 41.9 | -1 | 14 | 22.6 | Aug. | 4 | 295 | 09 | 26.9 | -1 | 35 | 49.7 |
| Feb. | 5 | 295 | 20 | 15.4 | 1 | 14 | 52.5 | | 9 | 295 | 02 | 44.2 | 1 | 36 | 12.5 |
| | 10 | 295 | 29 | 35.0 | 1 | 15 | 23.2 | | 14 | 294 | 56 | 17.9 | 1 | 36 | 34.1 |
| | 15 | 295 | 38 | 35.5 | 1 | 15 | 54.9 | | 19 | 294 | 50 | 13.2 | 1 | 36 | 54.5 |
| | 20 | 295 | 47 | 14.2 | 1 | 16 | 27.5 | | 24 | 294 | 44 | 32.4 | 1 | 37 | 13.8 |
| | 25 | 295 | 55 | 28.8 | 1 | 17 | 00.9 | | 29 | 294 | 39 | 18.2 | 1 | 37 | 32.0 |
| Mar. | 2 | 296 | 03 | 15.2 | -1 | 17 | 35.2 | Sept. | 3 | 294 | 34 | 34.7 | -1 | 37 | 49.1 |
| | 7 | 296 | 10 | 32.1 | 1 | 18 | 10.2 | | 8 | 294 | 30 | 23.9 | 1 | 38 | 05.3 |
| | 12 | 296 | 17 | 16.5 | 1 | 18 | 46.1 | | 13 | 294 | 26 | 48.7 | 1 | 38 | 20.6 |
| | 17 | 296 | 23 | 25.1 | 1 | 19 | 22.6 | | 18 | 294 | 23 | 52.1 | 1 | 38 | 35.2 |
| | 22 | 296 | 28 | 57.0 | 1 | 19 | 59.7 | | 23 | 294 | 21 | 34.2 | 1 | 38 | 49.0 |
| | 27 | 296 | 33 | 50.1 | 1 | 20 | 37.5 | | 28 | 294 | 19 | 57.6 | 1 | 39 | 02.3 |
| Apr. | 1 | 296 | 38 | 02.5 | -1 | 21 | 15.8 | Oct. | 3 | 294 | 19 | 03.7 | -1 | 39 | 15.0 |
| | 6 | 296 | 41 | 34.3 | 1 | 21 | 54.5 | | 8 | 294 | 18 | 52.6 | 1 | 39 | 27.4 |
| | 11 | 296 | 44 | 22.6 | 1 | 22 | 33.6 | | 13 | 294 | 19 | 26.7 | 1 | 39 | 39.5 |
| | 16 | 296 | 46 | 27.5 | 1 | 23 | 12.9 | | 18 | 294 | 20 | 44.5 | 1 | 39 | 51.4 |
| | 21 | 296 | 47 | 49.1 | 1 | 23 | 52.5 | | 23 | 294 | 22 | 46.1 | 1 | 40 | 03.3 |
| | 26 | 296 | 48 | 26.3 | 1 | 24 | 32.2 | | 28 | 294 | 25 | 31.9 | 1 | 40 | 15.2 |
| May | 1 | 296 | 48 | 20.8 | -1 | 25 | 11.9 | Nov. | 2 | 294 | 29 | 00.4 | -1 | 40 | 27.2 |
| | 6 | 296 | 47 | 32.3 | 1 | 25 | 51.6 | | 7 | 294 | 33 | 11.2 | 1 | 40 | 39.6 |
| | 11 | 296 | 46 | 00.9 | 1 | 26 | 31.0 | | 12 | 294 | 38 | 03.5 | 1 | 40 | 52.4 |
| | 16 | 296 | 43 | 49.0 | 1 | 27 | 10.2 | | 17 | 294 | 43 | 33.9 | 1 | 41 | 05.6 |
| | 21 | 296 | 40 | 57.4 | 1 | 27 | 49.0 | | 22 | 294 | 49 | 41.9 | 1 | 41 | 19.4 |
| | 26 | 296 | 37 | 28.0 | 1 | 28 | 27.3 | | 27 | 294 | 56 | 25.0 | 1 | 41 | 33.8 |
| | 31 | 296 | 33 | 24.1 | -1 | 29 | 05.1 | Dec. | 2 | 295 | 03 | 40.3 | -1 | 41 | 49.0 |
| June | 5 | 296 | 28 | 46.0 | 1 | 29 | 42.2 | | 7 | 295 | 11 | 26.9 | 1 | 42 | 05.1 |
| | 10 | 296 | 23 | 37.4 | 1 | 30 | 18.6 | | 12 | 295 | 19 | 40.3 | 1 | 42 | 22.1 |
| | 15 | 296 | 18 | 01.5 | 1 | 30 | 54.1 | | 17 | 295 | 28 | 17.6 | 1 | 42 | 40.1 |
| | 20 | 296 | 12 | 00.4 | 1 | 31 | 28.7 | | 22 | 295 | 37 | 16.6 | 1 | 42 | 59.1 |
| | 25 | 296 | 05 | 39.0 | 1 | 32 | 02.4 | | 27 | 295 | 46 | 33.0 | 1 | 43 | 19.3 |
| | 30 | 295 | 58 | 59.9 | -1 | 32 | 35.0 | | 32 | 295 | 56 | 04.4 | -1 | 43 | 40.6 |
| July | 5 | 295 | 52 | 06.0 | -1 | 33 | 06.4 | | 37 | 296 | 05 | 47.7 | -1 | 44 | 03.2 |

N.B : Pluto is now classified as a dwarf planet as per resolution of I.A.U

**PLUTO, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Red. To Astrom. (J 2000.0) | Apparent Declination | | | Red. To Astrom. (J 2000.0) | True Distance from the Earth | Hor. Parallax | Ephemeris Transit | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | s | ° | ' | " | " | | " | h | m |
| Jan. | 1 | 19 | 45 | 14.54 | +72.43 | -22 | 27 | 00.4 | -177.94 | 35.147 176 | 0.25 | 13 | 00 |
| | 6 | 19 | 45 | 56.75 | 72.43 | 22 | 25 | 40.2 | 178.93 | 35.167 019 | 0.25 | 12 | 41 |
| | 11 | 19 | 46 | 39.42 | 72.46 | 22 | 24 | 18.8 | 180.28 | 35.179 593 | 0.25 | 12 | 22 |
| | 16 | 19 | 47 | 22.30 | 72.50 | 22 | 22 | 57.5 | 181.27 | 35.184 797 | 0.25 | 12 | 03 |
| | 21 | 19 | 48 | 05.06 | 72.52 | 22 | 21 | 36.4 | 182.57 | 35.182 624 | 0.25 | 11 | 44 |
| | 26 | 19 | 48 | 47.51 | 72.58 | 22 | 20 | 16.2 | 183.99 | 35.173 156 | 0.25 | 11 | 25 |
| | 31 | 19 | 49 | 29.39 | +72.65 | -22 | 18 | 58.1 | -185.11 | 35.156 523 | 0.25 | 11 | 06 |
| Feb. | 5 | 19 | 50 | 10.40 | 72.69 | 22 | 17 | 42.3 | 186.32 | 35.132 871 | 0.25 | 10 | 47 |
| | 10 | 19 | 50 | 50.43 | 72.80 | 22 | 16 | 29.4 | 187.70 | 35.102 366 | 0.25 | 10 | 28 |
| | 15 | 19 | 51 | 29.11 | 72.87 | 22 | 15 | 20.6 | 188.73 | 35.065 241 | 0.25 | 10 | 09 |
| | 20 | 19 | 52 | 06.24 | 72.94 | 22 | 14 | 15.9 | 190.00 | 35.021 824 | 0.25 | 9 | 50 |
| | 25 | 19 | 52 | 41.67 | 73.06 | 22 | 13 | 16.1 | 191.25 | 34.972 498 | 0.25 | 9 | 31 |
| Mar. | 2 | 19 | 53 | 15.12 | +73.15 | -22 | 12 | 22.2 | -192.21 | 34.917 671 | 0.25 | 9 | 12 |
| | 7 | 19 | 53 | 46.47 | 73.27 | 22 | 11 | 34.0 | 193.54 | 34.857 741 | 0.25 | 8 | 53 |
| | 12 | 19 | 54 | 15.54 | 73.40 | 22 | 10 | 52.6 | 194.53 | 34.793 135 | 0.25 | 8 | 33 |
| | 17 | 19 | 54 | 42.09 | 73.50 | 22 | 10 | 18.3 | 195.50 | 34.724 360 | 0.25 | 8 | 14 |
| | 22 | 19 | 55 | 06.05 | 73.64 | 22 | 09 | 51.2 | 196.68 | 34.651 977 | 0.25 | 7 | 55 |
| | 27 | 19 | 55 | 27.27 | 73.79 | 22 | 09 | 32.2 | 197.50 | 34.576 566 | 0.25 | 7 | 36 |
| Apr. | 1 | 19 | 55 | 45.62 | +73.91 | -22 | 09 | 21.1 | -198.44 | 34.498 694 | 0.25 | 7 | 16 |
| | 6 | 19 | 56 | 01.11 | 74.09 | 22 | 09 | 18.3 | 199.41 | 34.418 905 | 0.26 | 6 | 57 |
| | 11 | 19 | 56 | 13.55 | 74.23 | 22 | 09 | 24.3 | 200.01 | 34.337 786 | 0.26 | 6 | 37 |
| | 16 | 19 | 56 | 22.91 | 74.37 | 22 | 09 | 38.6 | 200.84 | 34.255 974 | 0.26 | 6 | 18 |
| | 21 | 19 | 56 | 29.22 | 74.56 | 22 | 10 | 01.6 | 201.56 | 34.174 118 | 0.26 | 5 | 58 |
| | 26 | 19 | 56 | 32.40 | 74.71 | 22 | 10 | 33.4 | 201.95 | 34.092 846 | 0.26 | 5 | 39 |
| May | 1 | 19 | 56 | 32.56 | +74.90 | -22 | 11 | 13.2 | -202.67 | 34.012 739 | 0.26 | 5 | 19 |
| | 6 | 19 | 56 | 29.69 | 75.09 | 22 | 12 | 01.6 | 202.97 | 33.934 359 | 0.26 | 4 | 59 |
| | 11 | 19 | 56 | 23.78 | 75.23 | 22 | 12 | 57.9 | 203.25 | 33.858 305 | 0.26 | 4 | 40 |
| | 16 | 19 | 56 | 15.01 | 75.42 | 22 | 14 | 01.6 | 203.64 | 33.785 185 | 0.26 | 4 | 20 |
| | 21 | 19 | 56 | 03.43 | 75.60 | 22 | 15 | 13.0 | 203.64 | 33.715 578 | 0.26 | 4 | 00 |
| | 26 | 19 | 55 | 49.16 | 75.75 | 22 | 16 | 30.8 | 203.73 | 33.650 002 | 0.26 | 3 | 40 |
| | 31 | 19 | 55 | 32.45 | +75.97 | -22 | 17 | 54.8 | -203.79 | 33.588 911 | 0.26 | 3 | 20 |
| June | 5 | 19 | 55 | 13.31 | 76.12 | 22 | 19 | 24.7 | 203.47 | 33.532 756 | 0.26 | 3 | 00 |
| | 10 | 19 | 54 | 51.98 | 76.27 | 22 | 20 | 59.2 | 203.35 | 33.482 001 | 0.26 | 2 | 40 |
| | 15 | 19 | 54 | 28.71 | 76.45 | 22 | 22 | 38.3 | 203.04 | 33.437 073 | 0.26 | 2 | 20 |
| | 20 | 19 | 54 | 03.63 | 76.58 | 22 | 24 | 21.0 | 202.45 | 33.398 333 | 0.26 | 2 | 00 |
| | 25 | 19 | 53 | 37.09 | 76.74 | 22 | 26 | 06.2 | 202.18 | 33.366 060 | 0.26 | 1 | 40 |
| | 30 | 19 | 53 | 09.28 | +76.89 | -22 | 27 | 53.8 | -201.45 | 33.340 477 | 0.26 | 1 | 20 |
| July | 5 | 19 | 52 | 40.39 | 76.98 | 22 | 29 | 42.6 | 200.77 | 33.321 813 | 0.26 | 1 | 00 |
| | 10 | 19 | 52 | 10.78 | 77.11 | 22 | 31 | 31.7 | 200.19 | 33.310 270 | 0.26 | 0 | 40 |
| | 15 | 19 | 51 | 40.66 | 77.22 | 22 | 33 | 20.8 | 199.22 | 33.305 985 | 0.26 | 0 | 19 |
| | 20 | 19 | 51 | 10.34 | 77.29 | 22 | 35 | 08.6 | 198.46 | 33.309 003 | 0.26 | 23 | 55 |
| | 25 | 19 | 50 | 40.18 | 77.40 | 22 | 36 | 54.5 | 197.66 | 33.319 292 | 0.26 | 23 | 35 |
| | 30 | 19 | 50 | 10.31 | +77.44 | -22 | 38 | 38.1 | -196.58 | 33.336 793 | 0.26 | 23 | 15 |
| Aug. | 4 | 19 | 49 | 41.09 | 77.49 | 22 | 40 | 18.1 | 195.80 | 33.361 442 | 0.26 | 22 | 55 |
| | 9 | 19 | 49 | 12.80 | 77.55 | 22 | 41 | 54.4 | 194.84 | 33.393 121 | 0.26 | 22 | 35 |
| | 14 | 19 | 48 | 45.64 | 77.54 | 22 | 43 | 26.1 | 193.77 | 33.431 632 | 0.26 | 22 | 14 |
| | 19 | 19 | 48 | 20.00 | +77.57 | -22 | 44 | 52.3 | -193.07 | 33.476 688 | 0.26 | 21 | 54 |

N.B: Pluto is now classified as a dwarf planet as per resolution of I A U

**PLUTO, 2021**

RIGHT ASCENSION AND DECLINATION FOR $0^h$ TERRESTRIAL TIME

| Date | | Apparent Right Ascension | | | Red. To Astrom. (J 2000.0) | Apparent Declination | | | Red. To Astrom. (J 2000.0) | True Distance from the Earth | Hor. Parallax | Ephemeris Transit | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h | m | s | s | ° | ' | " | " | | " | h | m |
| Aug. | 19 | 19 | 48 | 20.00 | +77.57 | -22 | 44 | 52.3 | -193.07 | 33.476 688 | 0.26 | 21 | 54 |
| | 24 | 19 | 47 | 56.03 | 77.58 | 22 | 46 | 13.2 | 192.00 | 33.527 955 | 0.26 | 21 | 34 |
| | 29 | 19 | 47 | 33.92 | 77.54 | 22 | 47 | 27.7 | 191.16 | 33.585 103 | 0.26 | 21 | 14 |
| Sept. | 3 | 19 | 47 | 13.99 | 77.53 | 22 | 48 | 35.5 | 190.48 | 33.647 778 | 0.26 | 20 | 54 |
| | 8 | 19 | 46 | 56.37 | 77.49 | 22 | 49 | 36.6 | 189.54 | 33.715 570 | 0.26 | 20 | 34 |
| | 13 | 19 | 46 | 41.25 | 77.42 | 22 | 50 | 30.0 | 188.97 | 33.787 988 | 0.26 | 20 | 15 |
| | 18 | 19 | 46 | 28.88 | +77.40 | -22 | 51 | 16.0 | -188.39 | 33.864 484 | 0.26 | 19 | 55 |
| | 23 | 19 | 46 | 19.24 | 77.30 | 22 | 51 | 54.3 | 187.71 | 33.944 517 | 0.26 | 19 | 35 |
| | 28 | 19 | 46 | 12.54 | 77.23 | 22 | 52 | 24.3 | 187.44 | 34.027 556 | 0.26 | 19 | 15 |
| Oct. | 3 | 19 | 46 | 08.87 | 77.17 | 22 | 52 | 46.6 | 187.05 | 34.113 048 | 0.26 | 18 | 55 |
| | 8 | 19 | 46 | 08.24 | 77.06 | 22 | 53 | 00.7 | 186.70 | 34.200 390 | 0.26 | 18 | 36 |
| | 13 | 19 | 46 | 10.81 | 77.00 | 22 | 53 | 06.4 | 186.79 | 34.288 922 | 0.26 | 18 | 16 |
| | 18 | 19 | 46 | 16.51 | +76.91 | -22 | 53 | 04.5 | -186.58 | 34.377 987 | 0.26 | 17 | 57 |
| | 23 | 19 | 46 | 25.31 | 76.80 | 22 | 52 | 54.3 | 186.71 | 34.466 973 | 0.26 | 17 | 37 |
| | 28 | 19 | 46 | 37.27 | 76.73 | 22 | 52 | 36.4 | 187.01 | 34.555 280 | 0.25 | 17 | 18 |
| Nov. | 2 | 19 | 46 | 52.26 | 76.64 | 22 | 52 | 11.1 | 187.11 | 34.642 300 | 0.25 | 16 | 58 |
| | 7 | 19 | 47 | 10.26 | 76.55 | 22 | 51 | 38.2 | 187.67 | 34.727 390 | 0.25 | 16 | 39 |
| | 12 | 19 | 47 | 31.23 | 76.51 | 22 | 50 | 58.2 | 188.16 | 34.809 901 | 0.25 | 16 | 20 |
| | 17 | 19 | 47 | 54.90 | +76.40 | -22 | 50 | 11.7 | -188.64 | 34.889 244 | 0.25 | 16 | 00 |
| | 22 | 19 | 48 | 21.24 | 76.34 | 22 | 49 | 18.5 | 189.50 | 34.964 890 | 0.25 | 15 | 41 |
| | 27 | 19 | 48 | 50.09 | 76.30 | 22 | 48 | 19.6 | 190.20 | 35.036 330 | 0.25 | 15 | 22 |
| Dec. | 2 | 19 | 49 | 21.22 | 76.21 | 22 | 47 | 15.3 | 190.97 | 35.103 059 | 0.25 | 15 | 03 |
| | 7 | 19 | 49 | 54.59 | 76.21 | 22 | 46 | 05.5 | 192.12 | 35.164 571 | 0.25 | 14 | 44 |
| | 12 | 19 | 50 | 29.86 | 76.17 | 22 | 44 | 51.6 | 192.91 | 35.220 404 | 0.25 | 14 | 25 |
| | 17 | 19 | 51 | 06.83 | +76.12 | -22 | 43 | 33.5 | -194.05 | 35.270 195 | 0.25 | 14 | 06 |
| | 22 | 19 | 51 | 45.35 | 76.13 | 22 | 42 | 12.0 | 195.25 | 35.313 636 | 0.25 | 13 | 46 |
| | 27 | 19 | 52 | 25.10 | 76.10 | 22 | 40 | 48.0 | 196.21 | 35.350 450 | 0.25 | 13 | 27 |
| | 32 | 19 | 53 | 05.92 | 76.10 | 22 | 39 | 21.5 | 197.57 | 35.380 370 | 0.25 | 13 | 09 |
| | 37 | 19 | 53 | 47.58 | +76.15 | -22 | 37 | 53.7 | -198.77 | 35.403 162 | 0.25 | 12 | 50 |

N.B: Pluto is now classified as a dwarf planet as per resolution of I A U

## MAJOR PLANETS, 2021

### HELIOCENTRIC OSCULATING ORBITAL ELEMENTS REFERRED TO THE MEAN ECLIPTIC AND EQUINOX OF J 2000.0

| Date | | Julian Date 245 | Inclination $i$ | Longitude Asc. Node $\Omega$ | Longitude Perihelion $\varpi$ | Mean Distance $a$ | Daily Motion $n$ | Eccentricity $e$ | Mean Longitude $L$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | **MERCURY** | | | | |
| | | | ° | ° | ° | | ° | | ° |
| Nov'20 | 23 | 9200.5 | 7.0037 | 48.305 | 77.491 | 0.387 098 | 4.092 35 | 0.205 637 | 261.1516 |
| Jan'21 | 2 | 9240.5 | 7.0037 | 48.305 | 77.492 | 0.387 098 | 4.092 36 | 0.205 636 | 64.8455 |
| Feb | 11 | 9280.5 | 7.0037 | 48.304 | 77.490 | 0.387 097 | 4.092 36 | 0.205 639 | 228.5395 |
| Mar | 23 | 9320.5 | 7.0037 | 48.304 | 77.490 | 0.387 098 | 4.092 35 | 0.205 636 | 32.2337 |
| May | 2 | 9360.5 | 7.0037 | 48.304 | 77.490 | 0.387 098 | 4.092 36 | 0.205 635 | 195.9277 |
| Jun | 11 | 9400.5 | 7.0037 | 48.304 | 77.490 | 0.387 099 | 4.092 34 | 0.205 631 | 359.6211 |
| Jul | 21 | 9440.5 | 7.0037 | 48.304 | 77.491 | 0.387 098 | 4.092 35 | 0.205 631 | 163.3149 |
| Aug | 30 | 9480.5 | 7.0036 | 48.303 | 77.492 | 0.387 100 | 4.092 32 | 0.205 623 | 327.0073 |
| Oct | 9 | 9520.5 | 7.0036 | 48.303 | 77.493 | 0.387 099 | 4.092 33 | 0.205 622 | 130.7003 |
| Nov | 18 | 9560.5 | 7.0036 | 48.303 | 77.493 | 0.387 099 | 4.092 33 | 0.205 624 | 294.3934 |
| Dec | 28 | 9600.5 | 7.0036 | 48.303 | 77.494 | 0.387 099 | 4.092 33 | 0.205 623 | 98.0867 |
| Feb' 22 | 6 | 9640.5 | 7.0036 | 48.302 | 77.492 | 0.387 098 | 4.092 36 | 0.205 628 | 261.7802 |
| | | | | | **VENUS** | | | | |
| Nov'20 | 23 | 9200.5 | 3.3946 | 76.623 | 131.70 | 0.723 325 | 1.602 15 | 0.006 790 | 207.0913 |
| Jan'21 | 2 | 9240.5 | 3.3945 | 76.623 | 131.75 | 0.723 330 | 1.602 14 | 0.006 786 | 271.1773 |
| Feb | 11 | 9280.5 | 3.3945 | 76.622 | 131.84 | 0.723 333 | 1.602 13 | 0.006 783 | 335.2615 |
| Mar | 23 | 9320.5 | 3.3945 | 76.622 | 131.90 | 0.723 327 | 1.602 15 | 0.006 788 | 39.3469 |
| May | 2 | 9360.5 | 3.3945 | 76.622 | 131.87 | 0.723 330 | 1.602 14 | 0.006 791 | 103.4327 |
| Jun | 11 | 9400.5 | 3.3945 | 76.622 | 131.81 | 0.723 329 | 1.602 14 | 0.006 790 | 167.5174 |
| Jul | 21 | 9440.5 | 3.3945 | 76.622 | 131.74 | 0.723 324 | 1.602 16 | 0.006 787 | 231.6034 |
| Aug | 30 | 9480.5 | 3.3945 | 76.622 | 131.75 | 0.723 328 | 1.602 15 | 0.006 779 | 295.6901 |
| Oct | 9 | 9520.5 | 3.3945 | 76.621 | 131.80 | 0.723 330 | 1.602 14 | 0.006 774 | 359.7749 |
| Nov | 18 | 9560.5 | 3.3945 | 76.621 | 131.76 | 0.723 334 | 1.602 13 | 0.006 774 | 63.8602 |
| Dec | 28 | 9600.5 | 3.3944 | 76.620 | 131.54 | 0.723 345 | 1.602 09 | 0.006 776 | 127.9423 |
| Feb' 22 | 6 | 9640.5 | 3.3944 | 76.618 | 131.40 | 0.723 333 | 1.602 13 | 0.006 766 | 192.0254 |
| | | | | | **EARTH*** | | | | |
| Nov'20 | 23 | 9200.5 | 0.0027 | 176.5 | 103.036 | 0.999 997 | 0.985 62 | 0.016 719 | 85.7961 |
| Jan'21 | 2 | 9240.5 | 0.0027 | 176.4 | 103.001 | 1.000 001 | 0.985 61 | 0.016 723 | 125.2195 |
| Feb | 11 | 9280.5 | 0.0027 | 176.3 | 102.956 | 0.999 993 | 0.985 62 | 0.016 725 | 164.6429 |
| Mar | 23 | 9320.5 | 0.0027 | 176.4 | 102.908 | 0.999 980 | 0.985 64 | 0.016 729 | 204.0674 |
| May | 2 | 9360.5 | 0.0027 | 176.3 | 102.906 | 0.999 980 | 0.985 64 | 0.016 728 | 243.4932 |
| Jun | 11 | 9400.5 | 0.0027 | 176.0 | 102.927 | 0.999 999 | 0.985 61 | 0.016 709 | 282.9182 |
| Jul | 21 | 9440.5 | 0.0027 | 175.6 | 102.946 | 1.000 018 | 0.985 58 | 0.016 686 | 322.3406 |
| Aug | 30 | 9480.5 | 0.0028 | 175.4 | 102.986 | 1.000 014 | 0.985 59 | 0.016 677 | 1.7625 |
| Oct | 9 | 9520.5 | 0.0028 | 175.5 | 103.047 | 0.999 997 | 0.985 62 | 0.016 677 | 41.1869 |
| Nov | 18 | 9560.5 | 0.0028 | 175.8 | 103.093 | 0.999 989 | 0.985 63 | 0.016 679 | 80.6130 |
| Dec | 28 | 9600.5 | 0.0028 | 174.5 | 103.167 | 0.999 997 | 0.985 61 | 0.016 687 | 120.0403 |
| Feb' 22 | 6 | 9640.5 | 0.0029 | 173.6 | 103.213 | 1.000 014 | 0.985 59 | 0.016 699 | 159.4648 |

* Values labelled for the Earth are actually for the Earth/ Moon barycenter

### FORMULAS

Mean anomaly, $M = L - \varpi$

Argument of perihelion, measured from node, $\omega = \varpi - \Omega$

True anomaly, $\nu = M + (2e - e^3/4)\sin M + (5e^2/4)\sin 2M + (13\, e^3/12)\sin 3M + \ldots$ in radians

True distance, $r = a\ (1 - e^2)/\ (1 + e \cos \nu)$

Heliocentric rectangular co-ordinates, referred to the ecliptic of date, may be computed from:

$x = r\{\cos(\nu + \omega)\cos\Omega - \sin(\nu + \omega)\cos i\ \sin\Omega\}$

$y = r\{\cos(\nu + \omega)\sin\Omega + \sin(\nu + \omega)\cos i\ \cos\Omega\}$

$z = r\sin(\nu + \omega)\sin i$

**MAJOR PLANETS, 2021**
HELIOCENTRIC OSCULATING ORBITAL ELEMENTS
REFERRED TO THE MEAN ECLIPTIC AND EQUINOX OF J 2000.0

| Date | Julian Date 245 | Inclination $i$ | Longitude Asc. Node $\Omega$ | Longitude Perihelion $\varpi$ | Mean Distance $a$ | Daily Motion $n$ | Eccentricity $e$ | Mean Longitude $L$ |
|---|---|---|---|---|---|---|---|---|
| | | | | MARS | | | | |
| | | ° | ° | ° | | ° | | ° |
| Nov'20 23 | 9200.5 | 1.8479 | 49.494 | 336.126 | 1.523 63 | 0.524 066 | 0.093 330 | 47.1825 |
| Jan'21 2 | 9240.5 | 1.8479 | 49.494 | 336.140 | 1.523 67 | 0.524 048 | 0.093 332 | 68.1446 |
| Feb 11 | 9280.5 | 1.8479 | 49.493 | 336.154 | 1.523 70 | 0.524 031 | 0.093 332 | 89.1052 |
| Mar 23 | 9320.5 | 1.8479 | 49.493 | 336.168 | 1.523 73 | 0.524 015 | 0.093 330 | 110.0647 |
| May 2 | 9360.5 | 1.8479 | 49.493 | 336.177 | 1.523 74 | 0.524 008 | 0.093 329 | 131.0238 |
| Jun 11 | 9400.5 | 1.8479 | 49.492 | 336.183 | 1.523 73 | 0.524 013 | 0.093 337 | 151.9828 |
| Jul 21 | 9440.5 | 1.8479 | 49.491 | 336.191 | 1.523 71 | 0.524 025 | 0.093 353 | 172.9420 |
| Aug 30 | 9480.5 | 1.8479 | 49.490 | 336.205 | 1.523 67 | 0.524 046 | 0.093 373 | 193.9019 |
| Oct 9 | 9520.5 | 1.8479 | 49.490 | 336.222 | 1.523 63 | 0.524 067 | 0.093 386 | 214.8628 |
| Nov 18 | 9560.5 | 1.8479 | 49.490 | 336.236 | 1.523 59 | 0.524 084 | 0.093 390 | 235.8251 |
| Dec 28 | 9600.5 | 1.8479 | 49.490 | 336.242 | 1.523 58 | 0.524 092 | 0.093 391 | 256.7886 |
| Feb' 22 6 | 9640.5 | 1.8479 | 49.490 | 336.237 | 1.523 60 | 0.524 083 | 0.093 401 | 277.7529 |
| | | | | JUPITER | | | | |
| Nov'20 23 | 9200.5 | 1.3036 | 100.516 | 13.926 | 5.203 69 | 0.083 070 | 0.048 599 | 310.4715 |
| Jan'21 2 | 9240.5 | 1.3036 | 100.516 | 13.915 | 5.203 70 | 0.083 070 | 0.048 587 | 313.7926 |
| Feb 11 | 9280.5 | 1.3036 | 100.516 | 13.910 | 5.203 68 | 0.083 070 | 0.048 575 | 317.1140 |
| Mar 23 | 9320.5 | 1.3036 | 100.515 | 13.916 | 5.203 61 | 0.083 072 | 0.048 559 | 320.4357 |
| May 2 | 9360.5 | 1.3036 | 100.516 | 13.921 | 5.203 52 | 0.083 074 | 0.048 537 | 323.7568 |
| Jun 11 | 9400.5 | 1.3036 | 100.516 | 13.914 | 5.203 49 | 0.083 074 | 0.048 523 | 327.0782 |
| Jul 21 | 9440.5 | 1.3036 | 100.516 | 13.907 | 5.203 49 | 0.083 075 | 0.048 515 | 330.4000 |
| Aug 30 | 9480.5 | 1.3036 | 100.516 | 13.907 | 5.203 48 | 0.083 075 | 0.048 513 | 333.7229 |
| Oct 9 | 9520.5 | 1.3036 | 100.516 | 13.928 | 5.203 36 | 0.083 078 | 0.048 497 | 337.0463 |
| Nov 18 | 9560.5 | 1.3036 | 100.516 | 13.950 | 5.203 17 | 0.083 083 | 0.048 469 | 340.3693 |
| Dec 28 | 9600.5 | 1.3036 | 100.516 | 13.965 | 5.202 97 | 0.083 088 | 0.048 432 | 343.6916 |
| Feb' 22 6 | 9640.5 | 1.3036 | 100.517 | 13.958 | 5.202 86 | 0.083 090 | 0.048 408 | 347.0132 |
| | | | | SATURN | | | | |
| Nov'20 23 | 9200.5 | 2.4863 | 113.595 | 90.744 | 9.572 5 | 0.033 299 | 0.052 400 | 306.2068 |
| Jan'21 2 | 9240.5 | 2.4863 | 113.595 | 90.608 | 9.572 7 | 0.033 298 | 0.052 467 | 307.5554 |
| Feb 11 | 9280.5 | 2.4863 | 113.595 | 90.476 | 9.572 8 | 0.033 298 | 0.052 540 | 308.9041 |
| Mar 23 | 9320.5 | 2.4862 | 113.595 | 90.354 | 9.572 9 | 0.033 297 | 0.052 626 | 310.2527 |
| May 2 | 9360.5 | 2.4862 | 113.595 | 90.245 | 9.572 9 | 0.033 297 | 0.052 707 | 311.5998 |
| Jun 11 | 9400.5 | 2.4862 | 113.595 | 90.129 | 9.573 1 | 0.033 296 | 0.052 778 | 312.9468 |
| Jul 21 | 9440.5 | 2.4863 | 113.595 | 90.012 | 9.573 3 | 0.033 295 | 0.052 851 | 314.2939 |
| Aug 30 | 9480.5 | 2.4863 | 113.595 | 89.899 | 9.573 4 | 0.033 295 | 0.052 939 | 315.6418 |
| Oct 9 | 9520.5 | 2.4863 | 113.595 | 89.818 | 9.573 2 | 0.033 296 | 0.053 051 | 316.9891 |
| Nov 18 | 9560.5 | 2.4863 | 113.595 | 89.762 | 9.572 8 | 0.033 298 | 0.053 162 | 318.3346 |
| Dec 28 | 9600.5 | 2.4863 | 113.596 | 89.721 | 9.572 5 | 0.033 299 | 0.053 263 | 319.6783 |
| Feb' 22 6 | 9640.5 | 2.4864 | 113.596 | 89.667 | 9.572 4 | 0.033 300 | 0.053 340 | 321.0209 |
| | | | | URANUS | | | | |
| Nov'20 23 | 9200.5 | 0.7703 | 74.097 | 172.62 | 19.186 2 | 0.011 735 | 0.045 987 | 42.8032 |
| Feb' 21 11 | 9280.5 | 0.7703 | 74.096 | 172.21 | 19.194 9 | 0.011 728 | 0.045 661 | 43.7392 |
| May 2 | 9360.5 | 0.7704 | 74.094 | 171.74 | 19.203 5 | 0.011 720 | 0.045 379 | 44.6796 |
| Jul 21 | 9440.5 | 0.7704 | 74.095 | 171.28 | 19.212 1 | 0.011 712 | 0.045 106 | 45.6192 |
| Oct 9 | 9520.5 | 0.7704 | 74.092 | 170.69 | 19.222 0 | 0.011 703 | 0.044 843 | 46.5641 |
| Dec 28 | 9600.5 | 0.7705 | 74.088 | 170.17 | 19.229 8 | 0.011 696 | 0.044 704 | 47.5149 |
| Mar' 22 18 | 9680.5 | 0.7706 | 74.086 | 169.71 | 19.236 9 | 0.011 689 | 0.044 566 | 48.4606 |
| | | | | NEPTUNE | | | | |
| Nov'20 23 | 9200.5 | 1.7695 | 131.758 | 19.59 | 30.215 1 | 0.005 938 | 0.010 940 | 350.4698 |
| Feb' 21 11 | 9280.5 | 1.7693 | 131.752 | 19.52 | 30.227 8 | 0.005 935 | 0.011 410 | 350.9696 |
| May 2 | 9360.5 | 1.7691 | 131.748 | 19.84 | 30.237 9 | 0.005 932 | 0.011 818 | 351.4729 |
| Jul 21 | 9440.5 | 1.7690 | 131.745 | 20.13 | 30.247 9 | 0.005 929 | 0.012 225 | 351.9758 |
| Oct 9 | 9520.5 | 1.7689 | 131.742 | 20.83 | 30.256 5 | 0.005 926 | 0.012 624 | 352.4869 |
| Dec 28 | 9600.5 | 1.7688 | 131.740 | 21.89 | 30.259 0 | 0.005 925 | 0.012 845 | 352.9964 |
| Mar' 22 18 | 9680.5 | 1.7688 | 131.739 | 22.64 | 30.262 8 | 0.005 924 | 0.013 080 | 353.5004 |

Distances are in astronomical units.

## CENTRE OF MASS OF THE SOLAR SYSTEM, 2021

HELIOCENTRIC RECTANGULAR CO-ORDINATES
EQUATORIAL RECTANGULAR CO-ORDINATES OF THE BARYCENTRES $S_4$ (SUN TO MARS) AND $S_9$ (SUN TO PLUTO) REFERRED TO THE MEAN EQUINOX AND EQUATOR OF J 2000.0

| Date | | Barycentre $S_4$ (In units of $10^{-10}$ a.u) | | | Centre of Mass of the Solar System Barycentre $S_9$ (In units of $10^{-9}$ a.u) | | |
|---|---|---|---|---|---|---|---|
| | | x | y | z | X | Y | Z |
| Jan. | 0 | +66429617 | -54699786 | -24864299 | +6644384 | -5471797 | -2487265 |
| | 10 | 67109935 | 54161939 | 24654866 | 6712532 | 5417712 | 2466164 |
| | 20 | 67784215 | 53614757 | 24441204 | 6780021 | 5362734 | 2444660 |
| | 30 | 68451768 | 53058555 | 24223448 | 6846810 | 5306883 | 2422762 |
| Feb. | 9 | 69112579 | 52493746 | 24001826 | 6912891 | 5250185 | 2400483 |
| | 19 | 69766740 | 51920028 | 23776206 | 6978262 | 5192628 | 2377818 |
| Mar. | 1 | +70413669 | -51337128 | -23546373 | +7042886 | -5134204 | -2354758 |
| | 11 | 71052644 | 50745155 | 23312306 | 7106721 | 5074923 | 2331304 |
| | 21 | 71683052 | 50144452 | 23074108 | 7169729 | 5014807 | 2307463 |
| | 31 | 72304397 | 49535464 | 22831943 | 7231878 | 4953883 | 2283245 |
| Apr. | 10 | 72916314 | 48918760 | 22586045 | 7293144 | 4892185 | 2258664 |
| | 20 | 73518514 | 48295047 | 22336738 | 7353505 | 4829753 | 2233738 |
| | 30 | +74111159 | -47665317 | -22084539 | +7412963 | -4766642 | -2208495 |
| May | 10 | 74695300 | 47030193 | 21829866 | 7471564 | 4702889 | 2182958 |
| | 20 | 75271901 | 46389341 | 21572646 | 7529350 | 4638482 | 2157126 |
| | 30 | 75841278 | 45742344 | 21312668 | 7586330 | 4573407 | 2130990 |
| June | 9 | 76403605 | 45088833 | 21049795 | 7642507 | 4507650 | 2104546 |
| | 19 | 76958953 | 44428427 | 20783862 | 7697878 | 4441198 | 2077788 |
| | 29 | +77507246 | -43760711 | -20514671 | +7752433 | -4374037 | -2050708 |
| July | 9 | 78048197 | 43085238 | 20242038 | 7806152 | 4306150 | 2023300 |
| | 19 | 78581265 | 42401789 | 19965849 | 7859002 | 4237532 | 1995560 |
| | 29 | 79106146 | 41710508 | 19686226 | 7910962 | 4168197 | 1967497 |
| Aug. | 8 | 79623055 | 41011104 | 19403118 | 7962037 | 4098136 | 1939111 |
| | 18 | 80131621 | 40302790 | 19116129 | 8012203 | 4027317 | 1910385 |
| | 28 | +80630804 | -39585088 | -18824950 | +8061402 | -3955722 | -1881306 |
| Sept. | 7 | 81119436 | 38857943 | 18529456 | 8109571 | 3883355 | 1851870 |
| | 17 | 81596316 | 38121621 | 18229697 | 8156644 | 3810236 | 1822083 |
| | 27 | 82060317 | 37376647 | 17925825 | 8202560 | 3736398 | 1791955 |
| Oct. | 7 | 82510321 | 36623835 | 17618133 | 8247257 | 3661889 | 1761504 |
| | 17 | 82945435 | 35864427 | 17307126 | 8290687 | 3586777 | 1730757 |
| | 27 | +83365515 | 35100027 | -16993586 | +8332837 | -3511150 | -1699757 |
| Nov. | 6 | 83771200 | 34331629 | 16677993 | 8373734 | 3435065 | 1668530 |
| | 16 | 84162815 | 33559737 | 16360569 | 8413390 | 3358554 | 1637091 |
| | 26 | 84540504 | 32785028 | 16041574 | 8451808 | 3281658 | 1605456 |
| Dec. | 6 | 84904567 | 32008285 | 15721322 | 8488998 | 3204424 | 1573643 |
| | 16 | 85255567 | 31230207 | 15400131 | 8524985 | 3126894 | 1541671 |
| | 26 | +85594150 | -30451338 | -15078278 | +8559796 | -3049103 | -1509558 |
| | 36 | +85921003 | -29672124 | -14755961 | +8593462 | -2971081 | -1477316 |

The heliocentric equatorial rectangular co-ordinates of the barycentre of the solar system referred to the mean equator and equinox of J 2021.5 are given by $\mathbf{r} = P\mathbf{r_0}$, where $\mathbf{r}$ and $\mathbf{r_0}$ are the column vectors of the co-ordinates X,Y, Z and $X_0$,$Y_0$, $Z_0$ referred to J 2021.5 and J 2000.0 respectively.

# PART - II

## STARS

**LONGITUDE AND LATITUDE OF STARS, 2021.5**

MEAN PLACES FOR JULY 2$^{d}$.375 TERRESTRIAL TIME

| Cat. No. FK5 | BS= HR No. | Star | Mag. | Longitude | | | Annual Variation | Annual Proper Motion | Latitude | | | Annual Variation | Annual Proper Motion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ° | ' | " | " | " | ° | ' | " | " | " |
| 35 | 280 | α Sculptoris | 4.31 | 0 | 47 | 42.08 | 50.610 | +0.025 | -32 | 30 | 46.79 | +0.040 | -0.007 |
| 9 | 74 | ι Ceti | 3.56 | 1 | 13 | 00.43 | 50.350 | -0.028 | -10 | 01 | 17.62 | +0.020 | -0.028 |
| 82 | 674 | φ Eridani | 3.56 | 1 | 18 | 20.00 | 51.180 | +0.110 | -58 | 59 | 09.15 | -0.030 | -0.082 |
| 902 | 9072 | ω Piscium | 4.01 | 2 | 53 | 03.09 | 50.340 | +0.095 | +6 | 21 | 44.29 | -0.100 | -0.167 |
| 22 | 188 | β Ceti | 2.04 | 2 | 53 | 10.94 | 50.720 | +0.242 | -20 | 47 | 00.89 | -0.010 | -0.068 |
| 783 | 7957 | η Cephei | 3.43 | 4 | 59 | 00.22 | 51.240 | +2.354 | +71 | 46 | 56.86 | +0.450 | +0.369 |
| 156 | 1336 | α Reticuli | 3.35 | 7 | 49 | 15.93 | 52.760 | +0.298 | -78 | 02 | 23.84 | +0.090 | -0.015 |
| 869 | 8762 | *o* Andromedae | 3.62 | 8 | 04 | 38.33 | 49.880 | +0.022 | +43 | 45 | 02.72 | +0.090 | -0.017 |
| 848 | 8585 | α Lacertae | 3.77 | 8 | 26 | 27.92 | 49.880 | +0.200 | +53 | 17 | 26.83 | +0.040 | -0.070 |
| 7 | 39 | γ Pegasi | 2.83 | 9 | 27 | 20.83 | 50.190 | +0.001 | +12 | 36 | 01.89 | +0.110 | -0.011 |
| 40 | 334 | η Ceti | 3.45 | 12 | 04 | 10.37 | 50.570 | +0.151 | -16 | 07 | 07.85 | -0.070 | -0.213 |
| 803 | 8162 | α Cephei | 2.44 | 13 | 04 | 24.79 | 49.480 | +0.340 | +68 | 54 | 50.29 | +0.040 | -0.100 |
| 836 | 8465 | ζ Cephei | 3.35 | 14 | 15 | 30.67 | 49.520 | +0.028 | +61 | 08 | 52.89 | +0.150 | -0.008 |
| 1 | 15 | α Andromedae* | 2.06 | 14 | 36 | 28.49 | 50.140 | +0.056 | +25 | 40 | 48.53 | -0.050 | -0.207 |
| 47 | 402 | θ Ceti | 3.6 | 16 | 31 | 34.42 | 50.260 | -0.163 | -15 | 46 | 02.73 | +0.000 | -0.171 |
| 723 | 7310 | δ Draconis | 3.07 | 17 | 26 | 44.35 | 47.550 | +0.757 | +82 | 53 | 12.50 | +0.080 | -0.093 |
| 59 | 509 | τ Ceti | 3.5 | 18 | 06 | 43.32 | 49.120 | -1.371 | -24 | 48 | 21.67 | +1.640 | +1.463 |
| 890 | 8961 | λ Andromedae | 3.82v | 18 | 35 | 02.70 | 49.750 | -0.133 | +43 | 46 | 27.71 | -0.250 | -0.441 |
| 1075 | 794 | ι Eridani | 4.11 | 19 | 04 | 34.49 | 51.010 | +0.169 | -51 | 42 | 49.78 | +0.100 | -0.095 |
| 71 | 585 | ν Ceti | 4 | 19 | 43 | 50.24 | 50.680 | +0.134 | -31 | 02 | 00.18 | +0.120 | -0.076 |
| 1033 | 361 | ζ Piscium* | 5.24 | 20 | 10 | 42.87 | 50.400 | +0.112 | +0 | 12 | 46.43 | +0.100 | -0.106 |
| 20 | 165 | δ Andromedae | 3.27 | 22 | 06 | 47.91 | 50.190 | +0.092 | +24 | 21 | 04.06 | +0.070 | -0.141 |
| 62 | 539 | ζ Ceti | 3.73 | 22 | 15 | 05.61 | 50.480 | +0.025 | -20 | 20 | 00.98 | +0.170 | -0.051 |
| 106 | 897 | θ Eridani p | 3.25 | 23 | 34 | 32.96 | 50.810 | -0.051 | -53 | 44 | 19.20 | +0.260 | +0.038 |
| 101 | 841 | β Fornacis | 4.46 | 26 | 32 | 19.48 | 50.920 | +0.212 | -45 | 51 | 14.33 | +0.350 | +0.103 |
| 1154 | 2015 | δ Doradus | 4.35 | 26 | 49 | 14.51 | 63.120 | -0.278 | -88 | 15 | 07.76 | +0.280 | +0.030 |
| 50 | 437 | η Piscium | 3.62 | 27 | 06 | 58.42 | 50.280 | +0.024 | +5 | 22 | 44.47 | +0.230 | -0.015 |
| 33 | 269 | μ Andromedae | 3.87 | 29 | 28 | 31.28 | 50.250 | +0.173 | +29 | 39 | 36.36 | +0.230 | -0.038 |
| 42 | 337 | β Andromedae | 2.06 | 30 | 42 | 18.89 | 50.230 | +0.126 | +25 | 56 | 38.09 | +0.100 | -0.178 |
| 863 | 8694 | ι Cephei | 3.52 | 33 | 32 | 05.88 | 49.280 | -0.304 | +62 | 37 | 03.64 | +0.280 | -0.017 |
| 66 | 553 | β Arietis* | 2.64 | 34 | 16 | 13.11 | 50.290 | +0.051 | +8 | 29 | 17.49 | +0.160 | -0.138 |
| 1085 | 919 | τ$^{3}$ Eridani | 4.09 | 34 | 50 | 08.09 | 50.390 | -0.198 | -38 | 54 | 15.23 | +0.300 | +0.001 |
| 17 | 153 | ζ Cassiopeiae | 3.66 | 35 | 21 | 48.90 | 49.960 | +0.016 | +44 | 43 | 17.39 | +0.290 | -0.018 |
| 2 | 21 | β Cassiopeiae | 2.27 | 35 | 25 | 01.66 | 50.320 | +0.463 | +51 | 12 | 50.23 | -0.160 | -0.472 |
| 809 | 8238 | β Cephei | 3.23 | 35 | 50 | 26.14 | 49.280 | +0.028 | +71 | 09 | 16.41 | +0.300 | -0.008 |
| 64 | 544 | α Trianguli | 3.41 | 37 | 09 | 36.55 | 50.110 | -0.079 | +16 | 48 | 03.83 | +0.090 | -0.223 |
| 91 | 779 | δ Ceti | 4.07 | 37 | 52 | 20.31 | 50.400 | +0.013 | -14 | 27 | 35.50 | +0.320 | -0.008 |
| 74 | 617 | α Arietis | 2 | 37 | 57 | 47.67 | 50.360 | +0.130 | +9 | 57 | 56.87 | +0.120 | -0.204 |
| 21 | 168 | α Cassiopeiae | 2.23 | 38 | 04 | 55.63 | 49.970 | +0.036 | +46 | 37 | 25.52 | +0.270 | -0.056 |
| 171 | 1465 | α Doradus | 3.27 | 38 | 08 | 17.11 | 51.700 | +0.155 | -74 | 34 | 48.30 | +0.290 | -0.031 |
| 104 | 874 | η Eridani | 3.89 | 39 | 03 | 04.66 | 50.460 | +0.008 | -24 | 32 | 46.27 | +0.090 | -0.233 |

* **No. 1 : *Alpheratz,* Uttara Bhadrapada - 2** **No. 66 : *Sheratan,* Asvini**
**No. 1033 : Revati**

Annual rate of Precession in longitude for the middle of the year = 50".29

**LONGITUDE AND LATITUDE OF STARS, 2021.5**

MEAN PLACES FOR JULY $2^{d}.375$ TERRESTRIAL TIME

| Cat. No. FK5 | BS= HR No. | Star | Mag. | Longitude | | | Annual Variation | Annual Proper Motion | Latitude | | | Annual Variation | Annual Proper Motion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ° | ' | " | " | " | ° | ' | " | " | " |
| 75 | 622 | β Trianguli | 3 | 42 | 39 | 10.85 | 50.310 | +0.134 | +20 | 34 | 55.97 | +0.260 | -0.091 |
| 79 | 664 | γ Trianguli | 4.01 | 43 | 49 | 04.83 | 50.210 | +0.028 | +18 | 57 | 00.00 | +0.280 | -0.064 |
| 32 | 264 | γ Cassiopeiae | var. | 44 | 13 | 46.29 | 49.970 | +0.027 | +48 | 49 | 00.85 | +0.340 | -0.019 |
| 73 | 603 | γ Andromed. p | 2.26 | 44 | 31 | 29.92 | 50.150 | +0.024 | +27 | 48 | 28.67 | +0.290 | -0.065 |
| 107 | 911 | α Ceti | 2.53 | 44 | 37 | 14.56 | 50.330 | -0.032 | -12 | 35 | 02.03 | +0.290 | -0.072 |
| 155 | 1326 | α Horologii | 3.86 | 46 | 07 | 37.90 | 50.770 | -0.073 | -61 | 43 | 47.80 | +0.150 | -0.211 |
| 48 | 403 | δ Cassiopeiae | 2.68 | 48 | 13 | 49.82 | 50.320 | +0.323 | +46 | 24 | 16.19 | +0.180 | -0.202 |
| 127 | 1084 | ε Eridani | 3.73 | 48 | 27 | 45.83 | 49.390 | -1.054 | -27 | 42 | 42.54 | +0.660 | +0.281 |
| 100 | 838 | 41 Arietis* | 3.63 | 48 | 30 | 13.48 | 50.270 | +0.029 | +10 | 27 | 04.20 | +0.240 | -0.132 |
| 135 | 1136 | δ Eridani | 3.54 | 51 | 09 | 50.32 | 50.550 | +0.113 | -28 | 40 | 10.58 | +1.130 | +0.744 |
| 121 | 1030 | *o* Tauri | 3.6 | 51 | 27 | 49.44 | 50.250 | -0.084 | -9 | 19 | 56.16 | +0.330 | -0.059 |
| 123 | 1038 | ξ Tauri | 3.74 | 52 | 12 | 46.48 | 50.380 | +0.049 | -8 | 47 | 47.67 | +0.340 | -0.052 |
| 212 | 1922 | β Doradus | 3.48v | 52 | 26 | 26.00 | 53.290 | +0.072 | -85 | 02 | 30.57 | +0.400 | +0.007 |
| 149 | 1231 | γ Eridani | 2.95 | 54 | 10 | 08.51 | 50.490 | +0.039 | -33 | 12 | 01.67 | +0.280 | -0.123 |
| 63 | 542 | ε Cassiopeiae | 3.38 | 55 | 03 | 45.29 | 50.060 | +0.024 | +47 | 33 | 01.61 | +0.370 | -0.034 |
| 109 | 921 | ρ Persei | var. | 55 | 12 | 40.49 | 50.300 | +0.099 | +20 | 34 | 34.46 | +0.270 | -0.139 |
| 1129 | 1502 | α Caeli | 4.45 | 56 | 26 | 56.17 | 50.390 | -0.346 | -62 | 59 | 09.30 | +0.390 | -0.032 |
| 111 | 936 | β Persei | var. | 56 | 28 | 02.69 | 50.210 | +0.003 | +22 | 25 | 51.67 | +0.410 | -0.002 |
| 103 | 854 | τ Persei | 3.95 | 58 | 12 | 40.63 | 50.150 | -0.003 | +34 | 22 | 25.55 | +0.420 | -0.005 |
| 99 | 834 | η Persei | 3.76 | 59 | 00 | 04.74 | 50.160 | +0.013 | +37 | 29 | 03.43 | +0.400 | -0.019 |
| 136 | 1142 | 17 Tauri | 3.7 | 59 | 42 | 43.99 | 50.290 | +0.009 | +4 | 11 | 31.54 | +0.370 | -0.049 |
| 170 | 1464 | $\nu^2$ Eridani | 3.82 | 60 | 11 | 12.10 | 50.470 | -0.076 | -51 | 48 | 52.81 | +0.420 | -0.002 |
| 151 | 1251 | ν Tauri | 3.91 | 60 | 13 | 11.42 | 50.350 | +0.005 | -14 | 26 | 56.98 | +0.430 | -0.004 |
| 139 | 1165 | η Tauri* | 2.87 | 60 | 17 | 33.73 | 50.290 | +0.008 | +4 | 03 | 11.48 | +0.380 | -0.049 |
| 108 | 915 | γ Persei | 2.93 | 60 | 19 | 15.63 | 50.160 | -0.002 | +34 | 31 | 57.94 | +0.420 | -0.004 |
| 893 | 8974 | γ Cephei | 3.21 | 60 | 23 | 33.75 | 50.150 | +0.268 | +64 | 40 | 23.41 | +0.550 | +0.119 |
| 150 | 1239 | λ Tauri | 3.47v | 60 | 56 | 05.97 | 50.310 | -0.009 | -7 | 57 | 26.29 | +0.420 | -0.011 |
| 120 | 1017 | α Persei | 1.79 | 62 | 22 | 50.76 | 50.210 | +0.018 | +30 | 07 | 40.50 | +0.400 | -0.030 |
| 144 | 1203 | ζ Persei | 2.85 | 63 | 25 | 26.48 | 50.270 | +0.004 | +11 | 20 | 09.72 | +0.420 | -0.011 |
| 134 | 1135 | ν Persei | 3.77 | 64 | 07 | 22.85 | 50.210 | -0.015 | +22 | 09 | 22.39 | +0.440 | +0.002 |
| 131 | 1122 | δ Persei | 3.01 | 65 | 06 | 07.38 | 50.230 | +0.021 | +27 | 18 | 15.07 | +0.400 | -0.040 |
| 148 | 1228 | ξ Persei | 4.04 | 65 | 16 | 21.21 | 50.250 | +0.002 | +14 | 56 | 47.24 | +0.440 | -0.000 |
| 147 | 1220 | ε Persei | 2.89 | 65 | 58 | 40.42 | 50.250 | +0.013 | +19 | 07 | 01.34 | +0.420 | -0.029 |
| 159 | 1346 | γ Tauri | 3.65 | 66 | 06 | 24.74 | 50.420 | +0.110 | -5 | 43 | 47.59 | +0.400 | -0.044 |
| 162 | 1373 | δ Tauri | 3.76 | 67 | 10 | 18.23 | 50.400 | +0.101 | -3 | 58 | 01.65 | +0.400 | -0.046 |
| 164 | 1409 | ε Tauri | 3.54 | 68 | 45 | 57.68 | 50.400 | +0.100 | -2 | 33 | 53.28 | +0.400 | -0.054 |
| 168 | 1457 | α Tauri* | 0.85 | 70 | 05 | 23.36 | 50.350 | +0.036 | -5 | 27 | 56.90 | +0.260 | -0.197 |
| 1134 | 1543 | $\pi^3$ Orionis | 3.19 | 72 | 13 | 41.28 | 50.800 | +0.481 | -15 | 22 | 54.21 | +0.410 | -0.046 |
| 186 | 1654 | ε Leporis | 3.19 | 72 | 21 | 24.12 | 50.420 | +0.021 | -44 | 57 | 44.41 | +0.380 | -0.076 |
| 179 | 1552 | $\pi^4$ Orionis | 3.69 | 72 | 24 | 04.86 | 50.330 | -0.001 | -16 | 46 | 08.99 | +0.460 | +0.001 |
| 180 | 1567 | $\pi^5$ Orionis | 3.72 | 72 | 47 | 28.84 | 50.330 | +0.000 | -20 | 00 | 08.44 | +0.460 | -0.000 |

* **No. 100 : Bharani** **No. 168 : *Aldebaran*, Rohini**

**No. 139 : *Alcyone*, Krittika.**

Annual rate of Precession in longitude for the middle of the year = 50".29

**LONGITUDE AND LATITUDE OF STARS, 2021.5**

MEAN PLACES FOR JULY $2^{d}.375$ TERRESTRIAL TIME

| Cat. No. FK5 | BS= HR No. | Star | Mag. | Longitude | | | Annual Variation | Annual Proper Motion | Latitude | | | Annual Variation | Annual Proper Motion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ° | ' | " | " | " | ° | ' | " | " | " |
| 188 | 1666 | β Eridani | 2.79 | 75 | 34 | 32.72 | 50.220 | -0.116 | -27 | 51 | 33.91 | +0.390 | -0.071 |
| 1144 | 1702 | μ Leporis | 3.31v | 75 | 41 | 42.98 | 50.410 | +0.051 | -39 | 02 | 50.93 | +0.430 | -0.030 |
| 695 | 6927 | χ Draconis | 3.57 | 76 | 11 | 39.49 | 44.140 | +3.498 | +83 | 34 | 17.91 | +0.630 | -0.501 |
| 181 | 1577 | ι Aurigae | 2.69 | 76 | 56 | 23.08 | 50.280 | +0.001 | +10 | 27 | 25.81 | +0.450 | -0.018 |
| 194 | 1713 | β Orionis | 0.12 | 77 | 07 | 48.61 | 50.340 | +0.000 | -31 | 07 | 12.02 | +0.460 | -0.001 |
| 195 | 1735 | τ Orionis | 3.6 | 78 | 08 | 51.52 | 50.310 | -0.018 | -29 | 50 | 05.70 | +0.460 | -0.007 |
| 1137 | 1612 | ζ Aurigae | 3.75 | 78 | 56 | 01.29 | 50.290 | +0.007 | +18 | 12 | 17.84 | +0.450 | -0.023 |
| 183 | 1605 | ε Aurigae | var. | 79 | 08 | 29.95 | 50.270 | -0.001 | +20 | 56 | 49.72 | +0.470 | -0.004 |
| 185 | 1641 | η Aurigae | 3.17 | 79 | 44 | 47.70 | 50.300 | +0.024 | +18 | 17 | 10.38 | +0.400 | -0.070 |
| 204 | 1829 | β Leporis | 2.84 | 79 | 58 | 22.44 | 50.320 | -0.015 | -43 | 54 | 44.22 | +0.380 | -0.088 |
| 201 | 1790 | γ Orionis | 1.64 | 81 | 14 | 48.46 | 50.290 | -0.010 | -16 | 48 | 48.10 | +0.450 | -0.013 |
| 178 | 1542 | α Camelopardi | 4.29 | 81 | 16 | 47.25 | 50.260 | +0.001 | +43 | 25 | 18.30 | +0.480 | +0.006 |
| 182 | 1603 | β Camelopardi | 4.03 | 81 | 34 | 04.70 | 50.260 | -0.010 | +37 | 26 | 01.48 | +0.450 | -0.015 |
| 207 | 1865 | α Leporis | 2.58 | 81 | 40 | 51.69 | 50.320 | +0.001 | -41 | 03 | 17.96 | +0.470 | +0.002 |
| 193 | 1708 | α Aurigae | 0.08 | 82 | 09 | 30.50 | 50.330 | +0.046 | +22 | 51 | 52.40 | +0.040 | -0.429 |
| 215 | 1956 | α Columbae | 2.64 | 82 | 28 | 11.60 | 50.340 | +0.009 | -57 | 22 | 21.30 | +0.450 | -0.027 |
| 206 | 1852 | δ Orionis | 2.23 | 82 | 41 | 48.79 | 50.300 | +0.002 | -22 | 57 | 10.18 | +0.470 | -0.002 |
| 202 | 1791 | β Tauri | 1.65 | 82 | 52 | 31.26 | 50.300 | +0.012 | +5 | 23 | 12.59 | +0.300 | -0.176 |
| 209 | 1899 | ι Orionis | 2.77 | 83 | 17 | 52.46 | 50.310 | +0.000 | -29 | 11 | 49.87 | +0.470 | +0.001 |
| 210 | 1903 | ε Orionis | 1.7 | 83 | 45 | 50.49 | 50.310 | +0.001 | -24 | 30 | 13.00 | +0.460 | -0.002 |
| (GC) | 1879 | λ Orionis* | 3.56 | 84 | 00 | 25.91 | 50.300 | -0.001 | -13 | 21 | 59.93 | +0.470 | -0.002 |
| 211 | 1910 | ζ Tauri | 3 | 85 | 05 | 05.91 | 50.290 | -0.000 | -2 | 11 | 34.64 | +0.450 | -0.021 |
| 217 | 1983 | γ Leporis | 3.6 | 85 | 08 | 37.53 | 49.860 | -0.440 | -45 | 49 | 03.22 | +0.110 | -0.359 |
| 219 | 1998 | ζ Leporis | 3.55 | 86 | 17 | 11.52 | 50.270 | -0.020 | -38 | 12 | 46.89 | +0.470 | -0.000 |
| 220 | 2004 | κ Orionis | 2.06 | 86 | 41 | 56.20 | 50.290 | +0.002 | -33 | 04 | 04.38 | +0.460 | -0.002 |
| 223 | 2040 | β Columbae | 3.12 | 86 | 43 | 13.96 | 50.410 | +0.136 | -59 | 10 | 27.79 | +0.870 | +0.400 |
| 222 | 2035 | δ Leporis | 3.81 | 87 | 28 | 09.26 | 50.570 | +0.301 | -44 | 17 | 53.45 | -0.180 | -0.653 |
| 907 | 424 | α Ursae Mins. | 2.02 | 88 | 52 | 06.76 | 50.400 | +0.037 | +66 | 06 | 14.53 | +0.430 | -0.036 |
| 224 | 2061 | α Orionis* | var. | 89 | 03 | 18.27 | 50.320 | +0.027 | -16 | 01 | 27.00 | +0.480 | +0.009 |
| 226 | 2085 | η Leporis | 3.71 | 89 | 11 | 59.64 | 50.220 | -0.051 | -37 | 35 | 59.84 | +0.600 | +0.140 |
| 229 | 2120 | η Columbae | 3.96 | 89 | 54 | 41.68 | 50.270 | +0.055 | -66 | 15 | 05.44 | +0.450 | -0.014 |
| 227 | 2088 | β Aurigae | 1.9 | 90 | 12 | 37.63 | 50.250 | -0.062 | +21 | 30 | 39.58 | +0.470 | +0.000 |
| 225 | 2077 | δ Aurigae | 3.72 | 90 | 13 | 14.55 | 50.420 | +0.095 | +30 | 50 | 51.03 | +0.340 | -0.125 |
| 1168 | 2219 | κ Aurigae | 4.35 | 93 | 39 | 52.80 | 50.230 | -0.066 | +6 | 06 | 17.47 | +0.200 | -0.264 |
| 241 | 2286 | μ Geminorum | 2.88 | 95 | 36 | 09.27 | 50.350 | +0.059 | +0 | 49 | 04.92 | +0.360 | -0.109 |
| 244 | 2298 | 8ε Monocerotis | 4.44 | 96 | 33 | 17.82 | 50.240 | -0.019 | -18 | 42 | 52.91 | +0.480 | +0.010 |
| 1173 | 2343 | ν Geminorum | 4.15 | 97 | 06 | 09.76 | 50.280 | -0.007 | -3 | 03 | 13.33 | +0.450 | -0.014 |
| 243 | 2294 | β Canis Maj. | 1.98 | 97 | 29 | 15.52 | 50.190 | -0.008 | -41 | 15 | 03.53 | +0.460 | -0.000 |
| 240 | 2282 | ζ Canis Maj. | 3.02 | 97 | 40 | 38.01 | 50.170 | +0.015 | -53 | 22 | 11.81 | +0.460 | +0.003 |
| 251 | 2421 | γ Geminorum | 1.93 | 99 | 24 | 18.83 | 50.330 | +0.045 | -6 | 44 | 24.08 | +0.420 | -0.039 |
| 254 | 2473 | ε Geminorum | 2.98 | 100 | 14 | 20.92 | 50.300 | -0.005 | +2 | 04 | 21.25 | +0.440 | -0.014 |

* **No. GC : *Mrgasiras*.** **No. 224 : *Betelgeuse*, Mag. 0.4 to 1.3 Ardra.**

Annual rate of Precession in longitude for the middle of the year = 50".29

**LONGITUDE AND LATITUDE OF STARS, 2021.5**

MEAN PLACES FOR JULY $2^{d}.375$ TERRESTRIAL TIME

| Cat. No. FK5 | BS= HR No. | Star | Mag. | Longitude | | | Annual Variation | Annual Proper Motion | Latitude | | | Annual Variation | Annual Proper Motion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ° | ' | " | " | " | ° | ' | " | " | " |
| 261 | 2540 | θ Geminorum | 3.6 | 101 | 25 | 26.17 | 50.320 | +0.003 | +11 | 01 | 57.21 | +0.400 | -0.048 |
| 256 | 2484 | ξ Geminorum | 3.36 | 101 | 30 | 31.72 | 50.170 | -0.101 | -10 | 06 | 09.85 | +0.250 | -0.200 |
| 257 | 2491 | α Canis Maj cg | -1.5 | 104 | 22 | 39.72 | 49.610 | -0.552 | -39 | 36 | 36.33 | -0.810 | -1.256 |
| 245 | 2326 | α Carinae | -0.7 | 105 | 15 | 27.43 | 49.720 | +0.075 | -75 | 49 | 16.03 | +0.470 | +0.024 |
| 269 | 2650 | ζ Geminorum | 3.79v | 105 | 17 | 25.71 | 50.280 | -0.009 | -2 | 02 | 10.40 | +0.440 | -0.002 |
| 252 | 2451 | ν Puppis | 3.17 | 107 | 26 | 45.43 | 49.900 | +0.008 | -66 | 04 | 17.94 | +0.430 | -0.006 |
| 279 | 2777 | δ Geminorum | 3.53 | 108 | 49 | 10.11 | 50.270 | -0.024 | +0 | 10 | 33.35 | +0.410 | -0.016 |
| 1180 | 2538 | κ Canis Maj. | 3.96 | 108 | 51 | 53.52 | 50.010 | -0.013 | -55 | 08 | 41.85 | +0.430 | +0.003 |
| 277 | 2763 | λ Geminorum | 3.58 | 109 | 04 | 43.71 | 50.230 | -0.042 | -5 | 37 | 58.48 | +0.380 | -0.043 |
| 282 | 2821 | ι Geminorum | 3.79 | 109 | 15 | 25.54 | 50.210 | -0.109 | +5 | 45 | 36.86 | +0.330 | -0.103 |
| 1187 | 2714 | 22 δ Monocerot | 4.15 | 109 | 41 | 40.06 | 50.220 | -0.002 | -21 | 44 | 32.69 | +0.440 | +0.005 |
| 287 | 2891 | α Gemino. *Cg** | 1.95 | 110 | 32 | 24.94 | 50.180 | -0.156 | +10 | 05 | 52.15 | +0.300 | -0.126 |
| 268 | 2618 | ε Canis Maj. | 1.5 | 111 | 03 | 42.22 | 50.050 | +0.006 | -51 | 21 | 27.56 | +0.420 | +0.003 |
| 270 | 2653 | $o^2$ Canis Maj. | 3.02 | 111 | 18 | 06.38 | 50.070 | -0.007 | -46 | 07 | 40.28 | +0.430 | +0.002 |
| 1183 | 2646 | σ Canis Maj. | 3.47 | 111 | 51 | 17.55 | 50.030 | -0.009 | -50 | 13 | 23.94 | +0.420 | +0.004 |
| 285 | 2845 | β Canis Min. | 2.9 | 112 | 29 | 29.29 | 50.190 | -0.047 | -13 | 29 | 06.00 | +0.370 | -0.046 |
| 317 | 3323 | *o* Ursae Maj. | 3.36 | 113 | 17 | 47.68 | 50.370 | -0.121 | +40 | 14 | 42.13 | +0.280 | -0.145 |
| 295 | 2990 | β Geminorum | 1.14 | 113 | 30 | 44.94 | 49.700 | -0.614 | +6 | 41 | 08.58 | +0.260 | -0.158 |
| 273 | 2693 | δ Canis Maj. | 1.86 | 113 | 41 | 41.32 | 50.040 | -0.006 | -48 | 27 | 02.57 | +0.420 | +0.004 |
| 294 | 2985 | κ Geminorum | 3.57 | 113 | 57 | 57.74 | 50.290 | -0.024 | +3 | 04 | 50.33 | +0.360 | -0.057 |
| 291 | 2943 | α C. Min. *cg* | 0.38 | 116 | 04 | 55.95 | 49.680 | -0.541 | -16 | 01 | 26.15 | -0.730 | -1.132 |
| 263 | 2553 | τ Puppis | 2.93 | 118 | 01 | 23.26 | 49.660 | +0.188 | -72 | 51 | 04.54 | +0.340 | -0.056 |
| 293 | 2970 | 26 α Monocerot | 3.93 | 119 | 34 | 47.71 | 50.060 | -0.078 | -30 | 27 | 05.17 | +0.350 | -0.033 |
| 283 | 2827 | η Canis Maj. | 2.45 | 119 | 50 | 05.39 | 49.960 | -0.008 | -50 | 36 | 23.14 | +0.390 | +0.004 |
| 278 | 2773 | π Puppis | 2.7 | 120 | 35 | 53.80 | 49.830 | -0.019 | -58 | 31 | 21.61 | +0.380 | +0.002 |
| 335 | 3569 | ι Ursae Maj. | 3.14 | 123 | 05 | 55.64 | 50.060 | -0.399 | +29 | 34 | 30.81 | +0.020 | -0.358 |
| 341 | 3594 | κ Ursae Maj. | 3.6 | 124 | 14 | 16.70 | 50.450 | -0.015 | +28 | 58 | 52.79 | +0.300 | -0.062 |
| 312 | 3249 | β Cancri | 3.52 | 124 | 33 | 25.91 | 50.210 | -0.032 | -10 | 17 | 08.77 | +0.310 | -0.058 |
| 321 | 3366 | η Cancri | 5.33 | 125 | 42 | 28.47 | 50.270 | -0.035 | +1 | 34 | 23.38 | +0.300 | -0.054 |
| 1204 | 3045 | ξ Puppis | 3.34 | 126 | 20 | 24.62 | 49.980 | -0.003 | -44 | 56 | 14.54 | +0.360 | -0.003 |
| 368 | 3888 | *v* Ursae Maj. | 3.8 | 126 | 34 | 05.78 | 50.320 | -0.261 | +42 | 39 | 10.27 | +0.080 | -0.269 |
| 328 | 3475 | ι Cancri | 4.02 | 126 | 38 | 48.23 | 50.340 | -0.013 | +10 | 25 | 41.99 | +0.300 | -0.047 |
| 358 | 3775 | θ Ursae Maj. | 3.17 | 127 | 33 | 39.04 | 49.700 | -0.820 | +34 | 53 | 34.59 | -0.510 | -0.862 |
| 1228 | 3449 | γ Cancri | 4.66 | 127 | 50 | 18.07 | 50.220 | -0.092 | +3 | 11 | 31.74 | +0.280 | -0.066 |
| 1194 | 2878 | ρ Puppis | 3.25 | 128 | 59 | 08.04 | 49.370 | -0.262 | -63 | 46 | 17.68 | +0.500 | +0.157 |
| 326 | 3461 | δ Cancri* | 3.94 | 129 | 01 | 21.38 | 50.340 | +0.043 | +0 | 04 | 40.20 | +0.110 | -0.225 |
| 1223 | 3410 | δ Hydrae | 4.16 | 130 | 36 | 14.09 | 50.150 | -0.064 | -12 | 23 | 26.67 | +0.300 | -0.024 |
| 433 | 4434 | λ Draconis | 3.84 | 130 | 38 | 13.54 | 50.790 | -0.026 | +57 | 14 | 34.56 | +0.290 | -0.040 |
| 1224 | 3418 | σ Hydrae | 4.44 | 131 | 30 | 34.42 | 50.190 | -0.013 | -14 | 36 | 00.21 | +0.300 | -0.022 |
| 308 | 3185 | ρ Puppis | 2.81 | 131 | 41 | 11.53 | 49.850 | -0.128 | -43 | 16 | 04.83 | +0.340 | +0.023 |
| 352 | 3705 | α Lyncis | 3.13 | 132 | 08 | 31.78 | 50.180 | -0.227 | +17 | 57 | 56.21 | +0.270 | -0.054 |

* **No. 287 : *Castor*, Punarvasu-2, Mag. 1.95 & 2.95. No. 326 : Pusya.**

Annual rate of Precession in longitude for the middle of the year = 50".29

**LONGITUDE AND LATITUDE OF STARS, 2021.5**

MEAN PLACES FOR JULY 2$^{d}$.375 TERRESTRIAL TIME

| Cat. No. FK5 | BS= HR No. | Star | Mag. | Longitude | | | Annual Variation | Annual Proper Motion | Latitude | | | Annual Variation | Annual Proper Motion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ° | ′ | ″ | ″ | ″ | ° | ′ | ″ | ″ | ″ |
| 1239 | 3627 | ξ Cancri | 5.14 | 133 | 30 | 40.66 | 50.330 | -0.000 | +5 | 25 | 32.89 | +0.320 | +0.005 |
| 550 | 5563 | β Ursae Min. | 2.08 | 133 | 37 | 35.54 | 51.410 | -0.044 | +72 | 59 | 21.48 | +0.280 | -0.031 |
| 337 | 3572 | α Cancri | 4.25 | 133 | 56 | 31.44 | 50.310 | +0.041 | -5 | 04 | 43.26 | +0.290 | -0.020 |
| 334 | 3547 | ζ Hydrae | 3.11 | 134 | 52 | 30.13 | 50.130 | -0.101 | -10 | 58 | 04.34 | +0.290 | -0.014 |
| 417 | 4301 | α Ursae Maj. | 1.79 | 135 | 29 | 59.67 | 50.640 | -0.087 | +49 | 40 | 52.46 | +0.180 | -0.125 |
| (329) | 3482 | ε Hydrae m* | 3.38 | 136 | 23 | 11.84 | 49.910 | -0.228 | -23 | 26 | 07.29 | +0.190 | -0.105 |
| 472 | 4787 | κ Draconis | 3.87v | 136 | 33 | 37.61 | 50.890 | -0.090 | +61 | 45 | 49.42 | +0.250 | -0.042 |
| 306 | 3165 | ζ Puppis | 2.25 | 138 | 50 | 49.89 | 49.620 | -0.057 | -58 | 20 | 46.14 | +0.280 | +0.000 |
| 416 | 4295 | β Ursae Maj. | 2.37 | 139 | 44 | 16.05 | 50.750 | +0.071 | +45 | 08 | 06.18 | +0.350 | +0.073 |
| 383 | 4033 | λ Ursae Maj. | 3.45 | 139 | 51 | 02.18 | 50.360 | -0.155 | +29 | 53 | 10.83 | +0.170 | -0.103 |
| 347 | 3665 | θ Hydrae | 3.88 | 140 | 35 | 22.74 | 50.430 | +0.224 | -13 | 03 | 07.62 | +0.010 | -0.255 |
| 367 | 3873 | ε Leonis | 2.98 | 141 | 00 | 19.40 | 50.320 | -0.040 | +9 | 43 | 00.41 | +0.240 | -0.026 |
| 386 | 4069 | μ Ursae Maj. | 3.05 | 141 | 32 | 09.56 | 50.420 | -0.101 | +28 | 59 | 58.64 | +0.250 | -0.003 |
| 371 | 3905 | μ Leonis | 3.88 | 141 | 43 | 47.27 | 50.200 | -0.188 | +12 | 20 | 58.67 | +0.130 | -0.127 |
| 569 | 5735 | γ Ursae Min. | 3.05 | 141 | 54 | 25.09 | 51.710 | -0.080 | +75 | 14 | 33.19 | +0.240 | -0.019 |
| 262 | 2550 | α Pictoris | 3.27 | 144 | 23 | 03.33 | 45.060 | -1.937 | -83 | 02 | 15.06 | +0.390 | +0.148 |
| 365 | 3852 | ο Leonis | 3.52 | 144 | 32 | 47.58 | 50.140 | -0.122 | -3 | 45 | 22.52 | +0.160 | -0.081 |
| 327 | 3468 | α Pyxidis | 3.68 | 146 | 47 | 52.40 | 49.800 | -0.022 | -48 | 55 | 17.48 | +0.230 | +0.006 |
| 354 | 3748 | α Hydrae | 1.98 | 147 | 34 | 42.34 | 50.100 | -0.026 | -22 | 22 | 51.51 | +0.240 | +0.026 |
| 309 | 3207 | $\gamma^2$ Velorum | 1.78 | 147 | 38 | 41.20 | 49.410 | -0.015 | -64 | 27 | 46.35 | +0.220 | +0.004 |
| 384 | 4031 | ζ Leonis | 3.44 | 147 | 51 | 59.27 | 50.400 | +0.020 | +11 | 51 | 58.82 | +0.210 | +0.000 |
| 1250 | 3845 | ι Hydrae | 3.91 | 147 | 56 | 31.16 | 50.260 | +0.070 | -14 | 16 | 34.49 | +0.170 | -0.044 |
| 379 | 3975 | η Leonis | 3.52 | 148 | 12 | 20.46 | 50.330 | -0.001 | +4 | 52 | 01.09 | +0.220 | -0.001 |
| 420 | 4335 | ψ Ursae Maj. | 3.01 | 149 | 06 | 53.59 | 50.540 | -0.054 | +35 | 32 | 19.11 | +0.150 | -0.055 |
| 380 | 3982 | α Leonis* | 1.35 | 150 | 07 | 41.29 | 50.060 | -0.235 | +0 | 27 | 55.93 | +0.120 | -0.082 |
| 447 | 4554 | γ Ursae Maj. | 2.44 | 150 | 46 | 50.50 | 50.870 | +0.104 | +47 | 08 | 35.02 | +0.260 | +0.065 |
| 303 | 3117 | χ Carinae | 3.47 | 151 | 01 | 17.79 | 48.990 | -0.105 | -70 | 19 | 31.81 | +0.190 | +0.001 |
| 456 | 4660 | δ Ursae Maj. | 3.31 | 151 | 22 | 08.94 | 50.960 | +0.119 | +51 | 39 | 29.82 | +0.270 | +0.074 |
| 364 | 3849 | κ Hydrae | 5.06 | 152 | 58 | 32.74 | 50.060 | -0.020 | -26 | 35 | 55.05 | +0.150 | -0.028 |
| 1243 | 3718 | θ Pyxidis | 4.72 | 153 | 21 | 26.79 | 49.940 | -0.008 | -39 | 02 | 00.48 | +0.160 | -0.012 |
| 441 | 4518 | χ Ursae Maj. | 3.71 | 153 | 57 | 42.31 | 50.510 | -0.177 | +41 | 32 | 40.68 | +0.120 | -0.048 |
| 396 | 4133 | ρ Leonis | 3.85 | 156 | 41 | 21.36 | 50.290 | -0.005 | +0 | 09 | 02.09 | +0.150 | -0.005 |
| 425 | 4377 | ν Ursae Maj. | 3.48 | 156 | 57 | 18.31 | 50.470 | -0.040 | +26 | 09 | 48.27 | +0.160 | +0.014 |
| 521 | 5291 | α Draconis | 3.65 | 157 | 45 | 43.31 | 51.210 | -0.111 | +66 | 21 | 45.74 | +0.100 | -0.037 |
| 1261 | 3970 | $\nu^2$ Hydrae | 4.6 | 158 | 37 | 25.86 | 50.060 | -0.045 | -23 | 10 | 37.42 | +0.140 | +0.003 |
| 483 | 4905 | ε Ursae Maj. | 1.77 | 159 | 14 | 18.49 | 51.080 | +0.150 | +54 | 19 | 12.01 | +0.200 | +0.070 |
| 381 | 3994 | λ Hydrae | 3.61 | 159 | 39 | 54.99 | 49.950 | -0.165 | -22 | 00 | 51.01 | -0.030 | -0.159 |
| 1270 | 4116 | δ Sextantis | 5.21 | 160 | 24 | 22.40 | 50.160 | -0.040 | -11 | 20 | 42.74 | +0.090 | -0.031 |
| 345 | 3634 | λ Velorum | 2.21 | 161 | 29 | 01.74 | 49.580 | -0.040 | -55 | 52 | 12.52 | +0.110 | +0.001 |
| 422 | 4357 | δ Leonis* | 2.56 | 161 | 37 | 07.53 | 50.600 | +0.188 | +14 | 20 | 01.84 | +0.050 | -0.062 |
| 423 | 4359 | θ Leonis | 3.34 | 163 | 43 | 25.33 | 50.350 | -0.025 | +9 | 40 | 27.34 | +0.000 | -0.096 |

* **No. 329 : Aslesa.** **No. 422 : *Zosma*, Purva Phalguni-1.**
**No. 380 : *Regulus*, Magha.**

Annual rate of Precession in longitude for the middle of the year = 50".29

**LONGITUDE AND LATITUDE OF STARS, 2021.5**

MEAN PLACES FOR JULY 2$^{d}$.375 TERRESTRIAL TIME

| Cat. No. FK5 | BS= HR No. | Star | Mag. | Longitude | | | Annual Variation | Annual Proper Motion | Latitude | | | Annual Variation | Annual Proper Motion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ° | ' | " | " | " | ° | ' | " | " | " |
| 1227 | 3447 | *o* Velorum | 3.62 | 165 | 01 | 40.14 | 49.170 | -0.073 | -66 | 16 | 33.28 | +0.080 | +0.001 |
| 389 | 4094 | μ Hydrae | 3.81 | 165 | 20 | 06.12 | 49.990 | -0.093 | -24 | 40 | 18.37 | -0.050 | -0.125 |
| 497 | 5054 | ζ Ursae Maj. pr | 2.27 | 166 | 00 | 20.73 | 51.180 | +0.188 | +56 | 22 | 47.23 | +0.140 | +0.067 |
| 1304 | 4527 | 93 Leonis* | 4.53v | 169 | 16 | 28.94 | 50.300 | -0.140 | +17 | 18 | 33.24 | -0.020 | -0.065 |
| 410 | 4232 | ν Hydrae | 3.11 | 170 | 39 | 55.18 | 50.110 | +0.004 | -21 | 47 | 47.48 | +0.260 | +0.221 |
| 444 | 4534 | β Leonis | 2.14 | 171 | 54 | 57.70 | 49.980 | -0.417 | +12 | 15 | 54.69 | -0.280 | -0.306 |
| 392 | 4104 | α Antliae | 4.25 | 172 | 44 | 18.58 | 49.850 | -0.089 | -37 | 25 | 39.26 | -0.010 | -0.025 |
| 315 | 3307 | ε Carinae | 1.86 | 173 | 25 | 12.75 | 48.700 | -0.093 | -72 | 40 | 47.83 | +0.000 | -0.012 |
| 1283 | 4287 | α Crateris | 4.08 | 173 | 59 | 08.11 | 49.590 | -0.512 | -22 | 43 | 00.21 | -0.060 | -0.074 |
| 485 | 4915 | α CVn sq | 2.9 | 174 | 52 | 03.51 | 50.390 | -0.302 | +40 | 07 | 14.32 | -0.070 | -0.069 |
| 426 | 4382 | δ Crateris | 3.56 | 176 | 59 | 06.82 | 49.950 | -0.206 | -17 | 34 | 18.33 | +0.130 | +0.139 |
| 509 | 5191 | η Ursae Maj. | 1.86 | 177 | 14 | 11.31 | 50.800 | -0.155 | +54 | 23 | 14.70 | -0.100 | -0.083 |
| 445 | 4540 | β Virginis | 3.61 | 177 | 28 | 09.46 | 51.090 | +0.789 | +0 | 41 | 39.80 | +0.020 | +0.047 |
| 353 | 3734 | κ Velorum | 2.5 | 179 | 11 | 11.96 | 49.320 | -0.027 | -63 | 43 | 18.92 | -0.030 | +0.000 |
| 531 | 5404 | θ Bootis | 4.05 | 182 | 54 | 59.22 | 51.250 | +0.148 | +60 | 06 | 20.63 | -0.520 | -0.456 |
| 639 | 6396 | ζ Draconis | 3.17 | 183 | 42 | 34.21 | 55.080 | -0.288 | +84 | 45 | 39.75 | -0.080 | -0.013 |
| 361 | 3803 | N Velorum | 3.13 | 184 | 30 | 28.95 | 49.270 | -0.056 | -64 | 14 | 20.57 | -0.100 | -0.020 |
| 460 | 4689 | η Virginis | 3.89 | 184 | 36 | 11.45 | 50.270 | -0.051 | +2 | 35 | 19.87 | -0.120 | -0.042 |
| 492 | 4983 | β Com | 4.26 | 184 | 39 | 35.14 | 49.270 | -1.319 | +32 | 30 | 51.05 | +0.350 | +0.429 |
| 571 | 5744 | ι Draconis | 3.29 | 185 | 15 | 28.02 | 51.590 | -0.059 | +71 | 05 | 35.00 | -0.070 | +0.004 |
| 351 | 3699 | ι Carinae | 2.25 | 185 | 37 | 11.68 | 49.150 | -0.048 | -67 | 07 | 01.07 | -0.100 | -0.011 |
| 1326 | 4828 | ρ Virginis | 4.88 | 185 | 48 | 54.13 | 50.530 | +0.116 | +13 | 32 | 31.70 | -0.140 | -0.049 |
| 375 | 3940 | φVelorum | 3.54 | 186 | 14 | 31.71 | 49.480 | -0.019 | -59 | 57 | 03.82 | -0.100 | -0.005 |
| 434 | 4450 | ξ Hydrae | 3.54 | 188 | 17 | 08.27 | 49.820 | -0.193 | -31 | 35 | 59.91 | -0.240 | -0.131 |
| 488 | 4932 | ε Virginis | 2.83 | 190 | 14 | 23.36 | 50.160 | -0.269 | +16 | 12 | 13.26 | -0.220 | -0.091 |
| 457 | 4662 | γ Corvi | 2.59 | 191 | 01 | 27.53 | 50.010 | -0.161 | -14 | 30 | 07.04 | -0.180 | -0.045 |
| 484 | 4910 | δ Virginis | 3.38 | 191 | 45 | 33.16 | 49.950 | -0.415 | +8 | 36 | 40.36 | -0.370 | -0.232 |
| 453 | 4630 | ε Corvi | 3 | 191 | 57 | 51.61 | 50.060 | -0.074 | -19 | 40 | 28.06 | -0.160 | -0.018 |
| 475 | 4813 | χ Virginis | 4.66 | 192 | 27 | 14.23 | 50.200 | -0.060 | -3 | 28 | 09.52 | -0.200 | -0.052 |
| 465 | 4757 | δ Corvi* | 2.95 | 193 | 45 | 02.47 | 50.060 | -0.140 | -12 | 11 | 54.45 | -0.360 | -0.211 |
| 319 | 3347 | β Volantis | 3.77 | 195 | 27 | 55.91 | 49.120 | +0.547 | -75 | 35 | 12.07 | -0.250 | -0.082 |
| 471 | 4786 | β Corvi | 2.65 | 197 | 40 | 03.37 | 50.180 | +0.026 | -18 | 02 | 45.51 | -0.220 | -0.048 |
| 535 | 5435 | γ Bootis | 3.03 | 197 | 57 | 54.85 | 50.540 | -0.268 | +49 | 33 | 03.45 | -0.110 | +0.079 |
| 513 | 5235 | η Bootis | 2.68 | 199 | 38 | 19.99 | 50.620 | +0.095 | +28 | 04 | 25.72 | -0.550 | -0.354 |
| 281 | 2803 | δ Volantis | 3.98 | 199 | 42 | 17.82 | 47.030 | -0.039 | -82 | 28 | 42.14 | -0.210 | -0.006 |
| 501 | 5107 | ζ Virginis | 3.37 | 201 | 59 | 15.81 | 50.080 | -0.284 | +9 | 44 | 33.12 | -0.280 | -0.066 |
| 534 | 5429 | ρ Bootis | 3.58 | 203 | 05 | 14.79 | 50.480 | -0.191 | +42 | 27 | 03.02 | -0.150 | +0.066 |
| 498 | 5056 | α Virginis* | 0.98 | 204 | 08 | 29.37 | 50.250 | -0.028 | -2 | 03 | 21.89 | -0.270 | -0.041 |
| 526 | 5340 | α Bootis* | -0 | 204 | 32 | 01.59 | 50.250 | -0.285 | +30 | 43 | 16.82 | -2.500 | -2.265 |
| 555 | 5602 | β Bootis | 3.5 | 204 | 33 | 14.74 | 50.820 | -0.039 | +54 | 08 | 57.69 | -0.280 | -0.044 |
| 495 | 5020 | γ Hydrae | 3 | 207 | 19 | 06.79 | 50.270 | +0.079 | -13 | 44 | 39.38 | -0.270 | -0.017 |

* **No. 1304 : Uttara Phalguni-2.** **No. 498 : *Spica*, Citra.**

**No. 465 : *Algorel*, Hasta.** **No. 526 : *Arcturus*, Svati.**

Annual rate of Precession in longitude for the middle of the year = 50".29

**LONGITUDE AND LATITUDE OF STARS, 2021.5**

MEAN PLACES FOR JULY $2^{d}.375$ TERRESTRIAL TIME

| Cat. No. FK5 | BS= HR No. | Star | Mag. | Longitude ° | ' | " | Annual Variation " | Annual Proper Motion " | Latitude ° | ' | " | Annual Variation " | Annual Proper Motion " |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 452 | 4621 | δ Centauri | 2.6 | 207 | 46 | 48.92 | 49.870 | -0.033 | -44 | 30 | 40.85 | -0.280 | -0.026 |
| 406 | 4199 | θ Carinae | 2.76 | 209 | 29 | 06.16 | 49.510 | -0.046 | -62 | 08 | 26.66 | -0.270 | -0.012 |
| 348 | 3685 | β Carinae | 1.68 | 212 | 15 | 33.88 | 48.660 | -0.463 | -72 | 14 | 18.69 | -0.410 | -0.133 |
| 496 | 5028 | ι Centauri | 2.75 | 213 | 25 | 34.76 | 49.810 | -0.305 | -26 | 01 | 09.45 | -0.510 | -0.219 |
| 563 | 5681 | δ Bootis | 3.47 | 213 | 27 | 41.58 | 50.910 | +0.189 | +48 | 57 | 48.24 | -0.360 | -0.069 |
| 525 | 5338 | ι Virginis | 4.08 | 214 | 05 | 55.88 | 50.480 | +0.140 | +7 | 11 | 43.18 | -0.710 | -0.409 |
| 523 | 5315 | κ Virginis | 4.19 | 214 | 47 | 38.39 | 50.270 | -0.039 | +2 | 54 | 43.12 | -0.160 | +0.135 |
| 436 | 4467 | λ Centauri | 3.13 | 214 | 50 | 27.03 | 49.700 | -0.045 | -56 | 47 | 28.60 | -0.330 | -0.033 |
| 455 | 4656 | δ Crucis | 2.8 | 215 | 57 | 44.02 | 49.830 | -0.042 | -50 | 25 | 17.64 | -0.340 | -0.033 |
| 468 | 4763 | γ Crucis | 1.63v | 217 | 02 | 20.85 | 50.160 | +0.257 | -47 | 50 | 03.46 | -0.520 | -0.199 |
| 1371 | 5359 | λ Virginis | 4.52 | 217 | 15 | 08.68 | 50.270 | -0.024 | +0 | 29 | 20.08 | -0.290 | +0.023 |
| 385 | 4037 | ω Carinae | 3.32 | 217 | 44 | 04.89 | 49.410 | -0.054 | -67 | 23 | 04.21 | -0.350 | -0.033 |
| 519 | 5287 | π Hydrae | 3.27 | 218 | 55 | 27.69 | 50.310 | +0.092 | -13 | 03 | 07.83 | -0.440 | -0.115 |
| 572 | 5747 | β Cr. Borealis | 3.68 | 219 | 25 | 03.13 | 50.350 | -0.286 | +46 | 03 | 08.02 | -0.310 | +0.018 |
| 1189 | 2736 | $\gamma^2$ Volantis | 3.78 | 220 | 08 | 21.49 | 46.900 | -0.682 | -82 | 37 | 08.42 | -0.360 | +0.065 |
| 545 | 5487 | μ Virginis | 3.88 | 220 | 25 | 59.23 | 50.550 | +0.203 | +9 | 40 | 06.46 | -0.600 | -0.268 |
| 442 | 4520 | λ Muscae | 3.64 | 221 | 17 | 16.34 | 49.590 | -0.181 | -58 | 30 | 33.48 | -0.390 | -0.054 |
| 508 | 5193 | μ Centauri | 3.04v | 221 | 50 | 07.53 | 50.100 | -0.015 | -28 | 58 | 53.28 | -0.370 | -0.028 |
| 481 | 4853 | β Crucis | 1.25 | 221 | 56 | 37.77 | 49.880 | -0.046 | -48 | 38 | 27.88 | -0.380 | -0.039 |
| 462 | 4730 | α Crucis A | 1.33 | 222 | 10 | 02.82 | 49.840 | -0.031 | -52 | 52 | 52.02 | -0.380 | -0.032 |
| 578 | 5793 | α Cr.Borealis | 2.23 | 222 | 35 | 57.28 | 50.810 | +0.201 | +44 | 19 | 16.39 | -0.390 | -0.044 |
| 520 | 5288 | θ Centauri | 2.06 | 222 | 36 | 22.53 | 49.850 | -0.317 | -22 | 05 | 09.75 | -1.020 | -0.672 |
| 608 | 6092 | τ Herculis | 3.89 | 224 | 41 | 18.55 | 50.910 | -0.065 | +65 | 49 | 40.67 | -0.330 | +0.032 |
| 512 | 5231 | ζ Centauri | 2.55 | 225 | 14 | 58.43 | 50.060 | -0.040 | -32 | 56 | 45.16 | -0.420 | -0.062 |
| 548 | 5531 | $\alpha^2$ Librae* | 2.75 | 225 | 22 | 57.18 | 50.210 | -0.082 | +0 | 19 | 49.20 | -0.460 | -0.095 |
| 504 | 5132 | ε Centauri | 2.3 | 225 | 51 | 12.67 | 50.030 | -0.023 | -39 | 35 | 18.06 | -0.400 | -0.028 |
| 297 | 3024 | ζ Volantis | 3.95 | 226 | 03 | 00.85 | 48.560 | -0.031 | -79 | 23 | 22.39 | -0.340 | +0.034 |
| 391 | 4102 | I Carinae | 4 | 228 | 22 | 50.68 | 49.660 | +0.052 | -67 | 53 | 07.75 | -0.400 | -0.027 |
| 564 | 5685 | β Librae | 2.61 | 229 | 40 | 18.46 | 50.240 | -0.089 | +8 | 29 | 36.16 | -0.430 | -0.043 |
| 583 | 5867 | β Serpentis | 3.67 | 230 | 15 | 01.84 | 50.570 | +0.093 | +34 | 19 | 27.17 | -0.410 | -0.026 |
| 537 | 5440 | η Centauri | 2.31 | 230 | 32 | 54.16 | 50.150 | -0.023 | -25 | 30 | 56.24 | -0.430 | -0.044 |
| 474 | 4798 | α Muscae | 2.69 | 230 | 40 | 18.11 | 49.850 | -0.044 | -56 | 33 | 34.55 | -0.440 | -0.043 |
| 556 | 5603 | σ Librae | 3.29 | 230 | 59 | 13.40 | 50.200 | -0.059 | -7 | 38 | 49.83 | -0.450 | -0.062 |
| 559 | 5652 | ι Librae | 4.54 | 231 | 18 | 17.54 | 50.260 | -0.024 | -1 | 51 | 07.82 | -0.430 | -0.047 |
| 582 | 5854 | α Serpentis | 2.65 | 232 | 22 | 37.54 | 50.550 | +0.134 | +25 | 30 | 22.10 | -0.310 | +0.079 |
| 591 | 5933 | γ Serpentis | 3.85 | 233 | 05 | 14.17 | 51.230 | +0.758 | +35 | 11 | 11.05 | -1.560 | -1.164 |
| 541 | 5469 | α Lupi | 2.3 | 233 | 48 | 11.65 | 50.140 | -0.016 | -30 | 01 | 42.25 | -0.430 | -0.024 |
| 518 | 5267 | β Centauri | 0.61 | 234 | 05 | 27.70 | 50.040 | -0.026 | -44 | 08 | 24.83 | -0.440 | -0.032 |
| 469 | 4773 | γ Muscae | 3.87 | 234 | 18 | 56.62 | 49.820 | -0.069 | -58 | 52 | 23.98 | -0.450 | -0.045 |
| 588 | 5892 | ε Serpentis | 3.71 | 234 | 37 | 57.84 | 50.520 | +0.121 | +24 | 00 | 17.43 | -0.310 | +0.091 |
| 553 | 5576 | κ Centauri | 3.13 | 235 | 05 | 39.93 | 50.180 | -0.011 | -24 | 02 | 02.58 | -0.430 | -0.029 |

* **No. 548 : *Zuben el Genubi*, Visakha.**

Annual rate of Precession in longitude for the middle of the year = 50".29

**LONGITUDE AND LATITUDE OF STARS, 2021.5**

MEAN PLACES FOR JULY $2^d.375$ TERRESTRIAL TIME

| Cat. No. FK5 | BS= HR No. | Star | Mag. | Longitude | | | Annual Variation | Annual Proper Motion | Latitude | | | Annual Variation | Annual Proper Motion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ° | ' | " | " | " | ° | ' | " | " | " |
| 552 | 5571 | β Lupi | 2.68 | 235 | 19 | 30.47 | 50.170 | -0.023 | -25 | 02 | 56.03 | -0.460 | -0.048 |
| 577 | 5787 | γ Librae | 3.91 | 235 | 26 | 19.94 | 50.380 | +0.061 | +4 | 23 | 00.97 | -0.390 | +0.024 |
| 585 | 5881 | μ Serpentis | 3.54 | 236 | 14 | 21.84 | 50.280 | -0.082 | +16 | 14 | 07.73 | -0.450 | -0.042 |
| 487 | 4923 | δ Muscae | 3.62 | 236 | 29 | 25.50 | 50.310 | +0.360 | -56 | 46 | 37.47 | -0.250 | +0.163 |
| 566 | 5705 | φ' Lupi | 3.56 | 237 | 47 | 37.47 | 50.160 | -0.067 | -17 | 10 | 53.11 | -0.520 | -0.105 |
| 1413 | 5838 | κ Librae | 4.74 | 238 | 03 | 27.51 | 50.290 | -0.013 | +0 | 01 | 20.93 | -0.530 | -0.109 |
| 579 | 5794 | ν Librae | 3.58 | 238 | 54 | 34.39 | 50.260 | -0.010 | -8 | 30 | 35.91 | -0.420 | +0.000 |
| 1402 | 5695 | δ Lupi | 3.22 | 238 | 57 | 24.16 | 50.210 | -0.008 | -21 | 25 | 43.16 | -0.450 | -0.029 |
| 626 | 6220 | η Herculis | 3.53 | 239 | 05 | 27.38 | 50.770 | +0.116 | +60 | 17 | 12.89 | -0.490 | -0.070 |
| 609 | 6095 | γ Herculis | 3.75 | 239 | 30 | 55.49 | 50.390 | -0.072 | +40 | 00 | 19.47 | -0.390 | +0.032 |
| 538 | 5460 | α Centauri cg | var. | 239 | 44 | 54.94 | 45.210 | -4.887 | -42 | 36 | 14.01 | -1.300 | -0.860 |
| 401 | 4174 | γ Chamaeleontis | 4.11 | 240 | 43 | 06.51 | 49.760 | -0.049 | -68 | 05 | 13.18 | -0.470 | -0.040 |
| 558 | 5649 | ζ Lupi | 3.41 | 241 | 03 | 23.92 | 50.070 | -0.099 | -32 | 50 | 05.02 | -0.530 | -0.104 |
| 618 | 6148 | β Herculis | 2.77 | 241 | 23 | 31.00 | 50.340 | -0.126 | +42 | 41 | 58.58 | -0.470 | -0.034 |
| 613 | 6117 | ω Herculis | 4.57 | 241 | 52 | 36.94 | 50.500 | +0.067 | +35 | 09 | 55.74 | -0.480 | -0.050 |
| 603 | 6056 | δ Ophiuchi | 2.74 | 242 | 36 | 09.85 | 50.330 | -0.018 | +17 | 14 | 15.78 | -0.580 | -0.149 |
| 539 | 5463 | α Circini | 3.19 | 242 | 39 | 40.52 | 50.010 | -0.104 | -46 | 12 | 24.91 | -0.730 | -0.292 |
| 594 | 5953 | δ Scorpii* | 2.32 | 242 | 52 | 17.59 | 50.290 | -0.001 | -1 | 59 | 20.00 | -0.470 | -0.038 |
| 592 | 5944 | π Scorpii | 2.89 | 243 | 14 | 24.46 | 50.270 | -0.006 | -5 | 28 | 41.28 | -0.460 | -0.027 |
| 597 | 5984 | β Scorpii pr | 2.62 | 243 | 29 | 25.41 | 50.300 | -0.002 | +1 | 00 | 18.23 | -0.460 | -0.020 |
| 605 | 6075 | ε Ophiuchi | 3.24 | 243 | 48 | 40.30 | 50.420 | +0.079 | +16 | 26 | 14.65 | -0.390 | +0.055 |
| 459 | 4674 | β Chamaeleonti | 4.26 | 245 | 44 | 08.88 | 49.900 | -0.083 | -63 | 35 | 49.63 | -0.480 | -0.034 |
| 411 | 4234 | $\delta^2$ Chamaeleont | 4.45 | 245 | 57 | 14.59 | 49.880 | -0.030 | -67 | 47 | 37.10 | -0.490 | -0.048 |
| 607 | 6084 | σ Scorpii | 2.89 | 248 | 05 | 59.54 | 50.280 | -0.007 | -4 | 02 | 24.80 | -0.470 | -0.022 |
| 634 | 6324 | ε Herculis | 3.92 | 248 | 37 | 40.66 | 50.390 | -0.085 | +53 | 14 | 44.76 | -0.430 | +0.019 |
| 622 | 6175 | ζ Ophiuchi | 2.56 | 249 | 31 | 47.21 | 50.330 | +0.010 | +11 | 23 | 19.59 | -0.420 | +0.028 |
| 560 | 5671 | γ Tr. Austrini | 2.89 | 249 | 41 | 32.77 | 50.080 | -0.082 | -48 | 06 | 21.41 | -0.510 | -0.056 |
| 616 | 6134 | α Scorpii cg* | var. | 250 | 03 | 44.93 | 50.280 | -0.006 | -4 | 34 | 22.05 | -0.480 | -0.022 |
| 620 | 6165 | τ Scorpii | 2.82 | 251 | 45 | 25.91 | 50.270 | -0.005 | -6 | 07 | 23.87 | -0.480 | -0.023 |
| 633 | 6299 | κ Ophiuchi | 3.2 | 252 | 07 | 12.82 | 50.030 | -0.339 | +31 | 49 | 59.33 | -0.510 | -0.046 |
| 589 | 5897 | β Tr.Australis | 2.85 | 252 | 08 | 25.36 | 50.100 | -0.100 | -41 | 57 | 04.49 | -0.900 | -0.435 |
| 653 | 6536 | β Draconis | 2.79 | 252 | 16 | 07.08 | 50.620 | -0.072 | +75 | 16 | 30.56 | -0.440 | +0.011 |
| 643 | 6418 | π Herculis | 3.16 | 252 | 22 | 06.92 | 50.420 | -0.051 | +59 | 32 | 53.01 | -0.460 | -0.000 |
| 542 | 5470 | α Apodis | 3.83 | 254 | 43 | 45.52 | 50.150 | -0.002 | -58 | 14 | 16.03 | -0.480 | -0.019 |
| 641 | 6410 | δ Herculis | 3.14 | 255 | 03 | 51.85 | 50.380 | -0.004 | +47 | 40 | 54.86 | -0.620 | -0.158 |
| 628 | 6241 | ε Scorpii | 2.29 | 255 | 37 | 54.89 | 49.690 | -0.588 | -11 | 44 | 35.80 | -0.790 | -0.327 |
| 1439 | 6247 | $\mu^1$ Scorpii | 3.08v | 256 | 27 | 21.00 | 50.270 | -0.008 | -15 | 25 | 34.02 | -0.490 | -0.026 |
| 1435 | 6229 | η Arae | 3.76 | 259 | 12 | 16.96 | 50.310 | +0.051 | -36 | 16 | 45.70 | -0.490 | -0.023 |
| 631 | 6285 | ζ Arae | 3.13 | 260 | 07 | 26.49 | 50.250 | -0.018 | -33 | 05 | 40.83 | -0.500 | -0.038 |
| 663 | 6588 | ι Herculis | 3.8 | 260 | 11 | 24.48 | 50.390 | -0.015 | +69 | 15 | 45.92 | -0.470 | +0.005 |
| 638 | 6380 | η Scorpii | 3.33 | 261 | 02 | 36.62 | 50.340 | +0.052 | -20 | 11 | 16.83 | -0.760 | -0.284 |

* **No. 594 : *Dschubba*, Anuradha** **No. 616 : *Antares*, Jyestha, Mag. 0.9 to 1.8.**

Annual rate of Precession in longitude for the middle of the year = 50".29

**LONGITUDE AND LATITUDE OF STARS, 2021.5**

MEAN PLACES FOR JULY $2^{d}.375$ TERRESTRIAL TIME

| Cat. No. FK5 | BS= HR No. | Star | Mag. | Longitude | | | Annual Variation | Annual Proper Motion | Latitude | | | Annual Variation | Annual Proper Motion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ° | ' | " | " | " | ° | ' | " | " | " |
| 625 | 6217 | α Tr. Austr. | 1.92 | 261 | 11 | 46.14 | 50.290 | +0.028 | -46 | 09 | 15.75 | -0.500 | -0.031 |
| 644 | 6453 | θ Ophiuchi | 3.27 | 261 | 41 | 42.79 | 50.300 | -0.002 | -1 | 50 | 47.10 | -0.490 | -0.020 |
| 656 | 6556 | α Ophiuchi | 2.08 | 262 | 45 | 00.27 | 50.470 | +0.163 | +35 | 49 | 51.91 | -0.690 | -0.220 |
| 611 | 6102 | γ Apodis | 3.89 | 263 | 00 | 09.23 | 50.080 | -0.191 | -56 | 00 | 37.95 | -0.580 | -0.106 |
| 649 | 6508 | ν Scorpii | 2.69 | 264 | 18 | 47.01 | 50.300 | +0.000 | -14 | 00 | 40.83 | -0.500 | -0.031 |
| 645 | 6461 | β Arae | 2.85 | 264 | 30 | 22.19 | 50.290 | -0.008 | -32 | 16 | 04.52 | -0.490 | -0.026 |
| 658 | 6561 | ξ Serpentis | 3.54 | 264 | 50 | 46.27 | 50.250 | -0.040 | +7 | 55 | 53.56 | -0.530 | -0.060 |
| 652 | 6527 | λ Scorpii* | 1.63 | 264 | 53 | 10.03 | 50.290 | -0.000 | -13 | 47 | 29.16 | -0.500 | -0.029 |
| 671 | 6688 | ξ Draconis | 3.75 | 265 | 03 | 31.74 | 50.820 | +0.525 | +80 | 16 | 48.65 | -0.390 | +0.085 |
| 651 | 6510 | α Arae | 2.95 | 265 | 14 | 04.16 | 50.260 | -0.031 | -26 | 33 | 49.91 | -0.550 | -0.072 |
| 667 | 6623 | μ Herculis | 3.42 | 265 | 31 | 20.13 | 49.840 | -0.452 | +51 | 05 | 47.29 | -1.230 | -0.762 |
| 665 | 6603 | β Ophiuchi | 2.77 | 265 | 38 | 12.49 | 50.240 | -0.051 | +27 | 56 | 16.26 | -0.320 | +0.158 |
| 648 | 6500 | δ Arae | 3.62 | 265 | 51 | 23.84 | 50.230 | -0.067 | -37 | 21 | 33.57 | -0.570 | -0.099 |
| 654 | 6553 | θ Scorpii | 1.87 | 265 | 53 | 59.83 | 50.320 | +0.016 | -19 | 38 | 52.61 | -0.470 | -0.001 |
| 660 | 6580 | κ Scorpii | 2.41 | 266 | 46 | 11.31 | 50.300 | -0.005 | -15 | 38 | 50.47 | -0.500 | -0.027 |
| 668 | 6629 | γ Ophiuchi | 3.75 | 266 | 55 | 57.85 | 50.260 | -0.023 | +26 | 06 | 28.54 | -0.550 | -0.074 |
| 666 | 6615 | $\iota^1$ Scorpii | 3.03 | 267 | 49 | 22.52 | 50.300 | +0.000 | -16 | 43 | 02.31 | -0.480 | -0.008 |
| 669 | 6630 | *G* Scorpii | 3.21 | 268 | 13 | 06.99 | 50.350 | +0.049 | -13 | 37 | 29.78 | -0.440 | +0.034 |
| 676 | 6705 | γ Draconis | 2.23 | 268 | 16 | 05.93 | 50.170 | -0.028 | +74 | 55 | 09.56 | -0.490 | -0.020 |
| 661 | 6582 | η Pavonis | 3.62 | 268 | 16 | 25.64 | 50.300 | -0.017 | -41 | 18 | 45.96 | -0.530 | -0.055 |
| 672 | 6695 | θ Herculis | 3.86 | 268 | 46 | 37.49 | 50.250 | +0.009 | +60 | 40 | 55.53 | -0.460 | +0.006 |
| 674 | 6703 | ξ Herculis | 3.7 | 269 | 29 | 47.88 | 50.390 | +0.139 | +52 | 40 | 57.82 | -0.480 | -0.017 |
| 673 | 6698 | ν Ophiuchi | 3.34 | 270 | 03 | 12.49 | 50.280 | -0.007 | +13 | 39 | 42.99 | -0.590 | -0.116 |
| 1471 | 6743 | θ Arae | 3.66 | 271 | 29 | 25.61 | 50.310 | -0.012 | -26 | 39 | 43.16 | -0.480 | -0.014 |
| 679 | 6746 | γ Sagittarii | 2.99 | 271 | 33 | 41.46 | 50.250 | -0.056 | -6 | 59 | 42.19 | -0.650 | -0.185 |
| 680 | 6771 | 72 Ophiuchi | 3.73 | 272 | 27 | 36.17 | 50.180 | -0.070 | +32 | 59 | 13.39 | -0.380 | +0.081 |
| 681 | 6779 | *o* Herculis | 3.83 | 272 | 59 | 47.07 | 50.220 | +0.002 | +52 | 10 | 53.07 | -0.460 | +0.009 |
| 682 | 6812 | μ Sagittarii | 3.86 | 273 | 30 | 49.92 | 50.290 | +0.002 | +2 | 20 | 21.49 | -0.470 | +0.001 |
| 683 | 6832 | η Sagittarii | 3.11 | 273 | 55 | 38.71 | 50.170 | -0.137 | -13 | 22 | 53.96 | -0.630 | -0.162 |
| 687 | 6859 | δ Sagittarii* | 2.7 | 274 | 52 | 53.55 | 50.340 | +0.034 | -6 | 28 | 30.84 | -0.490 | -0.029 |
| 691 | 6897 | α Telescopii | 3.51 | 275 | 22 | 26.49 | 50.310 | -0.021 | -22 | 39 | 03.40 | -0.510 | -0.053 |
| 689 | 6879 | ε Sagittarii | 1.85 | 275 | 22 | 43.55 | 50.260 | -0.045 | -11 | 03 | 19.20 | -0.580 | -0.122 |
| 688 | 6869 | η Serpentis | 3.26 | 275 | 58 | 32.35 | 49.650 | -0.614 | +20 | 25 | 43.28 | -1.140 | -0.677 |
| 692 | 6913 | λ Sagittarii | 2.81 | 276 | 37 | 01.85 | 50.250 | -0.053 | -2 | 08 | 22.14 | -0.640 | -0.183 |
| 697 | 6951 | θ Coronae Aust. | 4.64 | 276 | 50 | 41.16 | 50.360 | +0.031 | -19 | 03 | 58.39 | -0.490 | -0.024 |
| 1482 | 6973 | α Scuti | 3.85 | 279 | 18 | 59.43 | 50.230 | -0.037 | +14 | 54 | 56.05 | -0.770 | -0.310 |
| 214 | 1953 | γ Mensae | 5.19 | 279 | 52 | 06.24 | 50.820 | +1.082 | -79 | 59 | 20.00 | -0.760 | +0.239 |
| 1487 | 7039 | φ Sagittarii | 3.17 | 280 | 28 | 55.51 | 50.360 | +0.053 | -3 | 57 | 24.31 | -0.460 | -0.004 |
| 1489 | 7063 | β Scuti | 4.22 | 282 | 40 | 48.50 | 50.240 | -0.006 | +18 | 10 | 59.57 | -0.470 | -0.016 |
| 706 | 7121 | σ Sagittarii* | 2.02 | 282 | 41 | 08.82 | 50.310 | +0.008 | -3 | 27 | 09.16 | -0.510 | -0.055 |
| 710 | 7150 | $\xi^2$ Sagittarii | 3.51 | 283 | 45 | 05.94 | 50.330 | +0.032 | +1 | 39 | 30.51 | -0.460 | -0.015 |

* **No. 652 : *Schaula*, Mula.** **No. 706 : *Nunki*, Uttarasadha.**
**No. 687 : Purvasadha-1.**

Annual rate of Precession in longitude for the middle of the year = 50".29

**LONGITUDE AND LATITUDE OF STARS, 2021.5**

MEAN PLACES FOR JULY $2^d.375$ TERRESTRIAL TIME

| Cat. No. FK5 | BS= HR No. | Star | Mag. | Longitude | | | Annual Variation | Annual Proper Motion | Latitude | | | Annual Variation | Annual Proper Motion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ° | ' | " | " | " | ° | ' | " | " | " |
| 1496 | 7234 | τ Sagittarii | 3.32 | 285 | 08 | 03.29 | 50.230 | -0.083 | -5 | 05 | 34.69 | -0.680 | -0.243 |
| 699 | 7001 | α Lyrae | 0.03 | 285 | 37 | 04.39 | 50.490 | +0.505 | +61 | 43 | 54.21 | -0.180 | +0.256 |
| 720 | 7264 | π Sagittarii | 2.89 | 286 | 33 | 07.67 | 50.290 | -0.004 | +1 | 26 | 03.21 | -0.470 | -0.035 |
| 717 | 7236 | λ Aquilae | 3.44 | 287 | 37 | 55.92 | 50.210 | -0.029 | +17 | 33 | 45.47 | -0.520 | -0.087 |
| 754 | 7665 | δ Pavonis | 3.56 | 287 | 55 | 17.33 | 51.620 | +1.142 | -44 | 42 | 38.21 | -1.870 | -1.444 |
| 712 | 7176 | ε Aquilae | 4.02 | 288 | 33 | 40.10 | 50.080 | -0.075 | +37 | 33 | 51.64 | -0.500 | -0.066 |
| 705 | 7106 | β Lyrae | var. | 289 | 10 | 56.75 | 50.020 | +0.005 | +55 | 58 | 53.63 | -0.440 | -0.003 |
| 810 | 8254 | ν Octantis | 3.76 | 289 | 59 | 22.93 | 50.400 | -0.212 | -57 | 46 | 59.59 | -0.640 | -0.217 |
| 716 | 7235 | ζ Aquilae | 2.99 | 290 | 05 | 43.35 | 50.130 | -0.023 | +36 | 10 | 57.26 | -0.520 | -0.094 |
| 713 | 7178 | γ Lyrae | 3.24 | 292 | 13 | 15.10 | 49.980 | -0.003 | +55 | 00 | 37.70 | -0.420 | +0.003 |
| 775 | 7913 | β Pavonis | 3.42 | 292 | 47 | 43.92 | 50.470 | -0.055 | -45 | 57 | 24.96 | -0.390 | +0.028 |
| 730 | 7377 | δ Aquilae | 3.36 | 293 | 56 | 21.22 | 50.480 | +0.294 | +24 | 48 | 53.37 | -0.380 | +0.040 |
| 764 | 7790 | α Pavonis | 1.94 | 294 | 07 | 07.21 | 50.440 | -0.025 | -36 | 16 | 14.25 | -0.500 | -0.087 |
| 751 | 7623 | $\theta^1$ Sagittarii | 4.37 | 295 | 10 | 14.71 | 50.360 | +0.001 | -14 | 23 | 17.92 | -0.430 | -0.027 |
| 785 | 7986 | β Indi | 3.65 | 298 | 05 | 14.14 | 50.510 | +0.008 | -39 | 09 | 34.57 | -0.420 | -0.030 |
| 769 | 7869 | α Indi | 3.11 | 299 | 24 | 21.17 | 50.510 | +0.078 | -27 | 45 | 20.52 | -0.340 | +0.048 |
| 1508 | 7405 | α Vulpeculae | 4.44 | 299 | 48 | 18.22 | 49.810 | -0.209 | +45 | 51 | 20.00 | -0.460 | -0.076 |
| 746 | 7570 | η Aquilae | var. | 300 | 44 | 00.68 | 50.200 | +0.010 | +21 | 31 | 15.33 | -0.390 | -0.009 |
| 741 | 7525 | γ Aquilae | 2.72 | 301 | 14 | 18.40 | 50.150 | +0.020 | +31 | 14 | 28.58 | -0.380 | -0.005 |
| 11 | 98 | β Hydri | 2.8 | 301 | 17 | 27.70 | 53.530 | +2.665 | -64 | 47 | 55.06 | -2.310 | -1.953 |
| 1513 | 7488 | β Sagittae | 4.37 | 301 | 30 | 18.24 | 50.080 | +0.003 | +38 | 12 | 56.39 | -0.410 | -0.033 |
| 732 | 7417 | β Cygni *p* | 3.08 | 301 | 33 | 00.73 | 49.980 | +0.002 | +48 | 57 | 55.46 | -0.380 | -0.002 |
| 745 | 7557 | α Aquilae* | 0.77 | 302 | 04 | 48.03 | 50.830 | +0.697 | +29 | 18 | 10.08 | -0.110 | +0.262 |
| 749 | 7602 | β Aquilae | 3.71 | 302 | 43 | 22.04 | 50.090 | -0.064 | +26 | 39 | 14.51 | -0.860 | -0.481 |
| 743 | 7536 | δ Sagittae | 3.82 | 303 | 41 | 10.46 | 50.070 | +0.011 | +38 | 54 | 38.36 | -0.360 | +0.006 |
| 761 | 7754 | $\alpha^2$ Capricorni | 3.57 | 304 | 09 | 32.90 | 50.330 | +0.063 | +6 | 55 | 40.52 | -0.380 | -0.011 |
| 762 | 7776 | β Capricorni | 3.08 | 304 | 20 | 52.32 | 50.310 | +0.042 | +4 | 35 | 11.12 | -0.380 | -0.008 |
| 756 | 7710 | θ Aquilae | 3.23 | 305 | 36 | 44.31 | 50.220 | +0.041 | +20 | 19 | 29.72 | -0.360 | -0.005 |
| 752 | 7635 | γ Sagittae | 3.47 | 307 | 20 | 34.77 | 50.130 | +0.090 | +39 | 11 | 17.45 | -0.340 | +0.006 |
| 1550 | 8039 | γ Microscopii | 4.67 | 308 | 43 | 56.42 | 50.380 | -0.000 | -14 | 40 | 02.33 | -0.330 | +0.006 |
| 841 | 8502 | α Tucanae | 2.86 | 309 | 58 | 22.88 | 50.510 | -0.120 | -45 | 24 | 20.80 | -0.330 | -0.000 |
| 146 | 1208 | γ Hydri | 3.24 | 310 | 47 | 02.11 | 52.130 | +0.537 | -76 | 45 | 33.70 | -0.410 | -0.010 |
| 781 | 7950 | ε Aquarii | 3.77 | 312 | 01 | 24.39 | 50.270 | +0.024 | +8 | 04 | 42.14 | -0.360 | -0.042 |
| 1547 | 7990 | μ Aquarii | 4.73 | 313 | 21 | 30.13 | 50.280 | +0.035 | +8 | 14 | 16.31 | -0.360 | -0.041 |
| 768 | 7852 | ε Delphini | 4.03 | 314 | 21 | 37.04 | 50.110 | +0.007 | +29 | 04 | 16.22 | -0.330 | -0.024 |
| 726 | 7328 | κ Cygni | 3.77 | 315 | 12 | 48.81 | 49.450 | +0.396 | +73 | 48 | 03.37 | -0.230 | +0.080 |
| 829 | 8425 | α Gruis | 1.74 | 316 | 12 | 33.05 | 50.600 | +0.064 | -32 | 54 | 58.32 | -0.490 | -0.191 |
| (771) | 7882 | β Delphini m* | 3.64 | 316 | 38 | 26.70 | 50.140 | +0.070 | +31 | 54 | 56.83 | -0.360 | -0.069 |
| 806 | 8204 | ζ Capricorni | 3.74 | 317 | 14 | 15.38 | 50.350 | +0.008 | -6 | 59 | 33.18 | -0.270 | +0.022 |
| 774 | 7906 | α Delphini | 3.77 | 317 | 40 | 47.78 | 50.130 | +0.074 | +33 | 01 | 13.55 | -0.310 | -0.022 |
| 822 | 8353 | γ Gruis | 3.01 | 317 | 43 | 16.30 | 50.550 | +0.095 | -23 | 03 | 08.49 | -0.340 | -0.058 |

* **No. 745 : *Altair*, Sravana.** **No. 771 : *Rotanev*, Dhanistha-1.**

Annual rate of Precession in longitude for the middle of the year = 50".29

## LONGITUDE AND LATITUDE OF STARS, 2021.5

MEAN PLACES FOR JULY $2^{d}.375$ TERRESTRIAL TIME

| Cat. No. FK5 | BS= HR No. | Star | Mag. | Longitude | | | Annual Variation | Annual Proper Motion | Latitude | | | Annual Variation | Annual Proper Motion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ° | ' | " | " | " | ° | ' | " | " | " |
| 733 | 7420 | ι Cygni | 3.79 | 318 | 15 | 49.34 | 49.420 | +0.252 | +71 | 27 | 00.00 | -0.180 | +0.104 |
| 778 | 7928 | δ Delphini | 4.43 | 318 | 24 | 54.03 | 50.020 | -0.037 | +31 | 56 | 30.21 | -0.320 | -0.035 |
| 1541 | 7948 | γ Delphini sq | 4.27 | 319 | 40 | 00.38 | 49.940 | -0.109 | +32 | 41 | 58.60 | -0.450 | -0.177 |
| 860 | 8675 | ε Gruis | 3.49 | 321 | 01 | 57.78 | 50.690 | +0.077 | -39 | 47 | 24.25 | -0.380 | -0.115 |
| 846 | 8556 | $\delta^{1}$ Gruis | 3.97 | 321 | 54 | 16.02 | 50.560 | +0.027 | -31 | 20 | 56.69 | -0.270 | -0.017 |
| 812 | 8278 | γ Capricorni | 3.68 | 322 | 05 | 32.20 | 50.490 | +0.172 | -2 | 33 | 33.65 | -0.340 | -0.084 |
| 856 | 8636 | β Gruis | 2.11v | 322 | 37 | 48.85 | 50.730 | +0.145 | -35 | 26 | 02.62 | -0.320 | -0.071 |
| 800 | 8131 | α Equulei | 3.92 | 323 | 25 | 00.88 | 50.180 | +0.029 | +20 | 07 | 11.11 | -0.350 | -0.102 |
| 808 | 8232 | β Aquarii | 2.91 | 323 | 41 | 42.70 | 50.260 | +0.017 | +8 | 36 | 48.40 | -0.260 | -0.015 |
| 819 | 8322 | δ Capricorni | 2.87 | 323 | 50 | 38.15 | 50.460 | +0.149 | -2 | 36 | 19.24 | -0.610 | -0.368 |
| 1569 | 8264 | ξ Aquarii | 4.69 | 324 | 25 | 09.30 | 50.360 | +0.103 | +5 | 57 | 21.12 | -0.300 | -0.062 |
| 765 | 7796 | γ Cygni | 2.2 | 325 | 08 | 17.40 | 49.670 | +0.007 | +57 | 07 | 22.84 | -0.240 | -0.001 |
| 780 | 7949 | ε Cygni | 2.46 | 328 | 02 | 50.15 | 50.510 | +0.705 | +49 | 25 | 18.83 | -0.060 | +0.155 |
| 815 | 8308 | ε Pegasi | var. | 332 | 11 | 03.92 | 50.150 | +0.031 | +22 | 05 | 55.28 | -0.190 | -0.011 |
| 849 | 8592 | ν Aquarii | 5.2 | 332 | 50 | 39.12 | 50.540 | +0.154 | -10 | 54 | 11.95 | -0.400 | -0.218 |
| 797 | 8115 | ζ Cygni | 3.2 | 333 | 20 | 20.81 | 49.850 | -0.031 | +43 | 41 | 36.16 | -0.220 | -0.051 |
| 827 | 8414 | α Aquarii | 2.96 | 333 | 53 | 03.48 | 50.220 | +0.015 | +11 | 15 | 29.79 | -0.190 | -0.016 |
| 867 | 8728 | α PsA | 1.16 | 334 | 09 | 47.41 | 50.720 | +0.253 | -21 | 08 | 18.11 | -0.460 | -0.287 |
| 777 | 7924 | α Cygni | 1.25 | 335 | 37 | 30.29 | 49.540 | +0.007 | +59 | 54 | 18.82 | -0.160 | +0.001 |
| 842 | 8518 | γ Aquarii | 3.84 | 337 | 00 | 53.18 | 50.360 | +0.126 | +8 | 14 | 02.49 | -0.190 | -0.042 |
| 834 | 8450 | θ Pegasi | 3.53 | 337 | 08 | 03.59 | 50.450 | +0.278 | +16 | 20 | 21.41 | -0.220 | -0.077 |
| 861 | 8679 | τ Aquarii | 4.01 | 338 | 53 | 46.43 | 50.310 | -0.026 | -5 | 39 | 55.77 | -0.170 | -0.030 |
| 866 | 8709 | δ Aquarii | 3.27 | 339 | 10 | 26.23 | 50.320 | -0.047 | -8 | 11 | 31.81 | -0.140 | -0.008 |
| 3 | 25 | ε Phoenicis | 3.88 | 339 | 57 | 03.43 | 50.710 | +0.011 | -41 | 57 | 29.23 | -0.340 | -0.220 |
| 850 | 8597 | η Aquarii | 4.02 | 340 | 47 | 32.94 | 50.290 | +0.064 | +8 | 21 | 48.67 | -0.200 | -0.087 |
| 792 | 8079 | ξ Cygni | 3.72 | 341 | 05 | 44.99 | 49.620 | +0.014 | +56 | 34 | 52.77 | -0.120 | -0.003 |
| 864 | 8698 | λ Aquarii* | 3.74 | 341 | 52 | 35.81 | 50.320 | +0.025 | +0 | 23 | 13.54 | -0.080 | +0.030 |
| 72 | 591 | α Hydri | 2.86 | 342 | 25 | 35.88 | 51.670 | +0.420 | -64 | 14 | 38.15 | -0.290 | -0.194 |
| 831 | 8430 | ι Pegasi | 3.76 | 344 | 42 | 33.16 | 50.320 | +0.339 | +34 | 15 | 15.59 | -0.190 | -0.104 |
| 54 | 472 | α Eridani | 0.46 | 345 | 37 | 00.85 | 51.160 | +0.084 | -59 | 22 | 44.92 | -0.160 | -0.092 |
| 12 | 99 | α Phoenicis | 2.39 | 345 | 47 | 46.26 | 50.650 | -0.042 | -40 | 38 | 10.35 | -0.520 | -0.444 |
| 855 | 8634 | ζ Pegasi | 3.4 | 346 | 27 | 05.60 | 50.220 | +0.072 | +17 | 40 | 43.51 | -0.110 | -0.043 |
| 141 | 1175 | β Reticuli | 3.85 | 351 | 42 | 40.54 | 52.980 | +0.796 | -76 | 05 | 23.24 | -0.290 | -0.260 |
| 878 | 8852 | γ Piscium | 3.69 | 351 | 45 | 26.97 | 50.950 | +0.713 | +7 | 15 | 18.80 | -0.310 | -0.285 |
| 871 | 8781 | α Pegasi | 2.49 | 353 | 47 | 06.86 | 50.170 | +0.043 | +19 | 24 | 19.99 | -0.080 | -0.065 |
| 1044 | 440 | δ Phoenicis | 3.95 | 353 | 55 | 41.21 | 51.250 | +0.337 | -52 | 34 | 57.03 | +0.020 | +0.035 |
| 862 | 8684 | μ Pegasi | 3.48 | 354 | 41 | 07.79 | 50.160 | +0.130 | +29 | 23 | 10.47 | -0.100 | -0.102 |
| 857 | 8650 | η Pegasi | 2.94 | 356 | 00 | 41.97 | 49.970 | +0.002 | +35 | 06 | 28.96 | -0.020 | -0.029 |
| 68 | 566 | χ Eridani | 3.7 | 356 | 33 | 35.41 | 52.330 | +1.308 | -57 | 01 | 06.99 | -0.200 | -0.210 |
| 49 | 429 | γ Phoenicis | 3.41 | 358 | 26 | 45.03 | 50.620 | -0.186 | -47 | 35 | 09.20 | -0.140 | -0.167 |
| 870 | 8775 | β Pegasi* | 2.42v | 359 | 40 | 28.18 | 50.290 | +0.270 | +31 | 08 | 27.47 | +0.070 | +0.037 |

* **No. 864 : Satabhisaj.** **No. 870 : *Scheat*, Purva Bhadrapada-2.**

BS = Bright Star Catalogue HR = Havard Revised Catalogue FK5 = Fifth Fundamental Catalogue

## MEAN PLACES OF STARS, J 2021.5

FOR JULY 2$^{d}$.375 TERRESTRIAL TIME

(The Annual Variations are for the middle of the year)

| Cat. No. FK5 | BS =HR No. | Star | Mag. | Spectral Type | Right Ascension | Annual Variation | Annual Proper motion | Declination | Annual Variation | Annual Proper motion |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | h m s | s | s (0.0001) | ° ' " | " | " (0.001) |
| 1 | 15 | α Andromedae* | 2.06 | B9 II | 0 09 30.2 | 3.117 | +104 | +29 12 32.65 | +19.86 | -163 |
| 2 | 21 | β Cassiopeiae* | 2.27 | F2 IV | 0 10 20.3 | 3.245 | +685 | +59 16 05.81 | 19.84 | -181 |
| 3 | 25 | ε Phoenicis | 3.88 | K0 III | 0 10 29.8 | 3.025 | +118 | -45 37 44.18 | 19.84 | -181 |
| 7 | 39 | γ Pegasi* | 2.83 | B2 IV | 0 14 20.7 | 3.098 | +2 | +15 18 10.67 | 19.99 | -12 |
| 9 | 74 | ι Ceti | 3.56 | K1.5 III | 0 20 31.4 | 3.056 | -9 | -8 42 17.65 | 19.92 | -36 |
| 11 | 98 | β Hydri | 2.80 | G0V | 0 26 51.0 | 3.055 | +6630 | -77 08 00.37 | 20.23 | +324 |
| 12 | 99 | α Phoenicis | 2.39 | K0.5 III b | 0 27 20.5 | 2.950 | +183 | -42 11 22.36 | +19.50 | -396 |
| 17 | 153 | ζ Cassiopeiae | 3.66 | B2 IV | 0 38 10.9 | 3.383 | +22 | +54 00 53.85 | 19.75 | -9 |
| 20 | 165 | δ Andromedae | 3.27 | K3 III | 0 40 29.0 | 3.227 | +106 | +30 58 41.85 | 19.64 | -92 |
| 21 | 168 | α Cassiopeiae* | 2.23 | K0- IIIa | 0 41 44.5 | 3.450 | +64 | +56 39 17.76 | 19.68 | -32 |
| 22 | 188 | β Ceti* | 2.04 | K0III | 0 44 40.1 | 3.008 | +164 | -17 52 08.18 | 19.69 | +32 |
| 33 | 269 | μ Andromedae | 3.87 | A5 V | 0 57 57.3 | 3.355 | +130 | +38 36 55.79 | 19.44 | +33 |
| 32 | 264 | γ Cassiopeiae* | 2.47 | B0 IVpe | 0 58 01.4 | 3.679 | +36 | +60 49 57.55 | +19.40 | -5 |
| 35 | 280 | α Sculptoris | 4.31 | B7IIIp | 0 59 38.4 | 2.885 | +17 | -29 14 30.16 | 19.37 | +4 |
| 40 | 334 | η Ceti | 3.45 | K1 III | 1 09 40.3 | 3.019 | +147 | -10 04 07.69 | 18.98 | -138 |
| 42 | 337 | β Andromedae* | 2.06 | M0III | 1 10 56.6 | 3.383 | +146 | +35 44 02.28 | 18.98 | -114 |
| 1033 | 361 | ζ Piscium* | 5.24 | A7IV | 1 14 51.4 | 3.143 | +97 | +7 41 18.43 | 18.93 | -56 |
| 47 | 402 | θ Ceti | 3.60 | K0 III | 1 25 05.9 | 3.001 | -53 | -8 04 23.08 | 18.46 | -218 |
| 48 | 403 | δ Cassiopeiae | 2.68 | A5 III-IVv | 1 27 14.5 | 3.987 | +401 | +60 20 46.41 | +18.56 | -52 |
| 49 | 429 | γ Phoenicis | 3.41 | Mo- IIIa | 1 29 17.8 | 2.597 | -13 | -43 12 31.20 | 18.33 | -208 |
| 1044 | 440 | δ Phoenicis | 3.95 | G9 III | 1 32 08.7 | 2.489 | +144 | -48 57 41.64 | 18.59 | +151 |
| 50 | 437 | η Piscium | 3.62 | G7 IIa | 1 32 38.3 | 3.223 | +19 | +15 27 21.30 | 18.42 | -6 |
| 54 | 472 | α Eridani* | 0.46 | B6Vep | 1 38 30.7 | 2.225 | +117 | -57 07 40.91 | 18.18 | -35 |
| 52 | 464 | 51 Andromedae | 3.57 | K3 III | 1 39 19.5 | 3.721 | +65 | +48 44 10.71 | 18.08 | -113 |
| 59 | 509 | τ Ceti | 3.50 | G8.5 V | 1 45 04.0 | 2.789 | -1190 | -15 49 29.63 | +18.83 | +858 |
| 62 | 539 | ζ Ceti | 3.73 | K0 III | 1 52 31.4 | 2.964 | +28 | -10 13 46.56 | 17.63 | -39 |
| 64 | 544 | α Trianguli | 3.41 | F5III | 1 54 18.8 | 3.441 | +9 | +29 40 57.72 | 17.36 | -235 |
| 66 | 553 | β Arietis* | 2.64 | A5 V | 1 55 49.9 | 3.329 | +68 | +20 54 44.00 | 17.42 | -111 |
| 63 | 542 | ε Cassiopeiae | 3.38 | B3III | 1 55 58.0 | 4.395 | +48 | +63 46 29.46 | 17.51 | -21 |
| 68 | 566 | χ Eridani | 3.70 | G8IV | 1 56 47.6 | 2.329 | +730 | -51 30 09.18 | 17.79 | +291 |
| 72 | 591 | α Hydri | 2.86 | F0IV | 1 59 26.8 | 1.889 | +368 | -61 27 56.85 | +17.41 | +26 |
| 71 | 585 | ν Ceti | 4.00 | F7III | 2 01 01.1 | 2.827 | +97 | -20 58 28.02 | 17.29 | -24 |
| 73 | 603 | γ Andromed.* p | 2.26 | K3- IIB | 2 05 13.7 | 3.714 | +40 | +42 25 54.69 | 17.07 | -52 |
| 70 | 580 | 50 Cassiopeiae | 3.98 | A2V | 2 05 19.0 | 5.272 | -99 | +72 31 26.17 | 17.14 | +22 |
| 74 | 617 | α Arietis* | 2.00 | K2 III | 2 08 23.4 | 3.399 | +138 | +23 33 47.12 | 16.83 | -149 |
| 75 | 622 | β Trianguli | 3.00 | A5 III | 2 10 49.8 | 3.595 | +122 | +35 05 16.61 | 16.82 | -41 |
| 82 | 674 | φ Eridani | 3.56 | B8IV- V | 2 17 16.7 | 2.141 | +102 | -51 24 48.32 | +16.53 | -27 |
| 79 | 664 | γ Trianguli | 4.01 | A1Vnn | 2 18 36.0 | 3.590 | +38 | +33 56 44.07 | 16.44 | -51 |
| 91 | 779 | δ Ceti | 4.07 | B2 IV | 2 40 35.2 | 3.083 | +9 | +0 25 12.55 | +15.32 | -4 |

* **No. 1 : *Alpheratz,* Uttara Bhadrapada - 2**
**No. 2 : *Caph***
**No. 7 : *Algenib,* Uttara Bhadrapada - 1**
**No. 21 : *Schedar*. Mag. 2.1 to 2.6**
**No. 22 : *Deneb Kaitos or Diphda***
**No. 32 : *Cih*. Mag. 1.6 to 3.2**
**No. 42 : *Mirach***
**No. 1033 : Revati**
**No. 54 : *Achernar***
**No. 66 : *Sheratan,* Asvini**
**No. 73 : *Almach,* Mag. f. 5.1**
**No. 74 : *Hamal***

## MEAN PLACES OF STARS, J 2021.5

FOR JULY 2$^{d}$.375 TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

| Cat. No. FK5 | BS =HR No. | Star | Mag. | Spec-tral Type | Right Ascension | Annual Variation | Annual Proper motion | Declination | Annual Variation | Annual Proper motion |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | h m s | s | s (0.0001) | ° ' " | " | " (0.001) |
| 1075 | 794 | ι Eridani | 4.11 | K0III | 2 41 30.9 | 2.367 | +119 | -39 45 51.45 | +15.24 | -32 |
| 94 | 801 | 35 Arietis | 4.66 | B3 V | 2 44 43.2 | 3.540 | +6 | +27 47 50.53 | 15.07 | -12 |
| 101 | 841 | β Fornacis | 4.46 | G8 5 IIIb | 2 49 59.4 | 2.512 | +71 | -32 18 59.78 | 14.93 | +155 |
| 100 | 838 | 41 Arietis* | 3.63 | B8 Vn | 2 51 15.3 | 3.550 | +50 | +27 20 52.19 | 14.58 | -118 |
| 99 | 834 | η Persei | 3.76 | K31b | 2 52 16.9 | 4.429 | +20 | +55 58 59.29 | 14.63 | -14 |
| 103 | 854 | τ Persei | 3.95 | G4 III+ | 2 55 47.8 | 4.299 | -0 | +52 50 56.07 | 14.42 | -5 |
| 104 | 874 | η Eridani | 3.89 | K1 III | 2 57 28.8 | 2.936 | +53 | -8 48 49.40 | +14.11 | -220 |
| 106 | 897 | θ Eridani* p | 3.25 | A3 IV-V | 2 59 04.6 | 2.276 | -39 | -40 13 10.09 | 14.25 | +19 |
| 907 | 424 | α Ursae Mins.* | 2.02 | F7:Ib-Iiv | 2 59 14.8 | 86.796 | +2146 | +89 21 14.20 | 14.20 | -19 |
| 1085 | 919 | τ Eridani | 4.09 | A3IV- V | 3 03 20.4 | 2.647 | -105 | -23 32 28.28 | 13.91 | -53 |
| 107 | 911 | α Ceti* | 2.53 | M1.5 IIIa | 3 03 24.4 | 3.145 | -6 | +4 10 22.15 | 13.88 | -78 |
| 108 | 915 | γ Persei | 2.93 | G8 III+ | 3 06 22.1 | 4.391 | -0 | +53 35 20.38 | 13.77 | -5 |
| 109 | 921 | ρ Persei* | 3.39 | M4 II | 3 06 33.7 | 3.871 | +111 | +38 55 19.53 | +13.65 | -106 |
| 111 | 936 | β Persei* | 2.12 | B8V | 3 09 34.6 | 3.932 | +3 | +41 02 13.09 | 13.57 | -1 |
| 120 | 1017 | α Persei* | 1.79 | F5 Iab | 3 25 52.1 | 4.321 | +25 | +49 56 09.38 | 12.46 | -25 |
| 121 | 1030 | ο Tauri | 3.60 | G6 III | 3 25 58.4 | 3.238 | -45 | +9 06 11.33 | 12.40 | -78 |
| 123 | 1038 | ξ Tauri | 3.74 | B9 Vn | 3 28 20.3 | 3.262 | +40 | +9 48 22.55 | 12.28 | -39 |
| 127 | 1084 | ε Eridani | 3.73 | K2 Vk | 3 33 56.7 | 2.832 | -658 | -9 23 12.09 | 11.95 | +23 |
| 135 | 1136 | δ Eridani | 3.54 | B1III-IV | 3 44 16.8 | 2.880 | -61 | -9 41 30.91 | +11.93 | +745 |
| 131 | 1122 | δ Persei | 3.01 | B5 III | 3 44 27.9 | 4.304 | +28 | +47 51 16.00 | 11.14 | -34 |
| 141 | 1175 | β Reticuli | 3.85 | K2 III | 3 44 28.6 | 0.774 | +490 | -64 44 23.02 | 11.25 | +75 |
| 136 | 1142 | 17 Tauri | 3.70 | B6 IIIe | 3 46 09.4 | 3.577 | +14 | +24 10 45.61 | 11.00 | -46 |
| 134 | 1135 | ν Persei | 3.77 | F5 Iab | 3 46 39.8 | 4.102 | -13 | +42 38 40.61 | 11.01 | -2 |
| 146 | 1208 | γ Hydri | 3.24 | M2 III | 3 46 55.7 | -0.854 | +116 | -74 10 21.69 | 11.11 | +114 |
| 139 | 1165 | η Tauri* | 2.87 | B7 III | 3 48 46.0 | 3.581 | +14 | +24 10 11.88 | +10.81 | -46 |
| 142 | 1178 | 27 Tauri | 3.63 | B8 III | 3 50 26.7 | 3.582 | +13 | +24 07 03.07 | 10.69 | -47 |
| 144 | 1203 | ζ Persei | 2.85 | B1 Ib | 3 55 29.3 | 3.789 | +4 | +31 56 44.64 | 10.35 | -10 |
| 149 | 1231 | γ Eridani | 2.95 | M 1 IIIb | 3 59 02.0 | 2.804 | +42 | -13 26 55.27 | 9.98 | -112 |
| 147 | 1220 | ε Persei | 2.89 | B 0.5 V+ | 3 59 18.2 | 4.049 | +16 | +40 04 13.93 | 10.05 | -26 |
| 148 | 1228 | ξ Persei | 4.04 | O 7.5 IIIe | 4 00 22.0 | 3.912 | +2 | +35 51 03.59 | 9.99 | 0 |
| 150 | 1239 | λ Tauri | 3.47v | B3 V+ | 4 01 52.5 | 3.334 | -4 | +12 32 58.34 | +9.87 | -12 |
| 151 | 1251 | ν Tauri | 3.91 | A0.5 Va | 4 04 18.1 | 3.200 | +3 | +6 02 50.76 | 9.69 | -3 |
| 152 | 1273 | 48 Persei | 4.04 | B3 Ve | 4 10 13.9 | 4.384 | +20 | +47 46 04.33 | 9.21 | -31 |
| 156 | 1336 | α Reticuli | 3.35 | G8II-III | 4 14 42.4 | 0.789 | +65 | -62 25 13.57 | 8.93 | +45 |
| 155 | 1326 | α Horologii | 3.86 | K2 III | 4 14 42.9 | 1.992 | +41 | -42 14 32.82 | 8.68 | -209 |
| 159 | 1346 | γ Tauri | 3.65 | K0III | 4 21 01.2 | 3.424 | +80 | +15 40 40.29 | 8.36 | -25 |
| 162 | 1373 | δ Tauri | 3.76 | K0III | 4 24 10.7 | 3.470 | +75 | +17 35 28.37 | +8.11 | -30 |
| 1121 | 1393 | 43 Eridani | 3.96 | K4 III | 4 24 50.7 | 2.257 | +56 | -33 58 05.17 | 8.13 | +50 |
| 164 | 1409 | ε Tauri | 3.54 | G9.5 III | 4 29 52.5 | 3.513 | +76 | +19 13 34.86 | 7.64 | -38 |
| 171 | 1465 | α Doradus | 3.27 | A0IIIs | 4 34 27.8 | 1.304 | +60 | -55 00 04.76 | 7.30 | -4 |
| 170 | 1464 | ν Eridani | 3.82 | G8IIIa | 4 36 23.3 | 2.336 | -35 | -30 31 10.21 | +7.14 | -12 |

* **No. 907 : (Nb) : *Polaris*, Dhruva**
**No. 100 : Bharani**
**No. 106 : Acamar.**
**No. 107 : *Menkar***
**No. 109 : Mag. 3.3 to 4.0.**
**No. 111 : *Algol*, Mag. 2.1 to 3.4.**
**No. 120 : *Mirphak.***
**No. 139 : *Alcyone*, Krittika.**

## MEAN PLACES OF STARS, J 2021.5

FOR JULY $2^d.375$ TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

| Cat. No. FK5 | BS =HR No. | Star | Mag. | Spec-tral Type | Right Ascension | Annual Variation | Annual Proper motion | Declination | Annual Variation | Annual Proper motion |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | h m s | s | s (0.0001) | ° ' " | " | " (0.001) |
| 168 | 1457 | α Tauri* | 0.85 | K5III | 4 37 09.4 | 3.451 | +44 | +16 33 02.79 | +6.90 | -190 |
| 172 | 1481 | 53 Eridani | 3.87 | K1III | 4 39 10.0 | 2.751 | -52 | -14 15 47.75 | 6.77 | -155 |
| 1129 | 1502 | α Caeli | 4.45 | F2 V | 4 41 15.3 | 1.937 | -126 | -41 49 25.61 | 6.67 | -77 |
| 1134 | 1543 | $\pi^3$ Orionis | 3.19 | F6 V | 4 51 00.6 | 3.263 | +313 | +6 59 49.59 | 5.95 | +11 |
| 179 | 1552 | $\pi^4$ Orionis | 3.69 | B2 III+ | 4 52 21.2 | 3.202 | -1 | +5 38 24.70 | 5.83 | +1 |
| 180 | 1567 | $\pi^5$ Orionis | 3.72 | B3 III+ | 4 55 22.4 | 3.131 | +0 | +2 28 27.25 | 5.58 | 0 |
| 178 | 1542 | α Camelopardi | 4.29 | O9.5 I ae | 4 56 12.1 | 6.012 | -1 | +66 22 34.11 | +5.51 | +6 |
| 181 | 1577 | ι Aurigae | 2.69 | K3 II | 4 58 23.8 | 3.918 | +3 | +33 11 53.25 | 5.30 | -18 |
| 183 | 1605 | ε Aurigae* | 2.99V | A8 Iab | 5 03 31.0 | 4.320 | -1 | +43 51 10.29 | 4.89 | -4 |
| 1137 | 1612 | ζ Aurigae | 3.75 | K4Ib-II+ | 5 03 59.1 | 4.207 | +8 | +41 06 18.13 | 4.83 | -22 |
| 182 | 1603 | β Camelopardi | 4.03 | G1Ib-II | 5 05 20.4 | 5.366 | -9 | +60 28 15.25 | 4.72 | -16 |
| 186 | 1654 | ε Leporis | 3.19 | K4 III | 5 06 22.3 | 2.543 | +18 | -22 20 36.64 | 4.57 | -74 |
| 185 | 1641 | η Aurigae | 3.17 | B3 V | 5 08 01.6 | 4.220 | +26 | +41 15 40.96 | +4.44 | -68 |
| 188 | 1666 | β Eridani* | 2.79 | A3III | 5 08 54.5 | 2.954 | -63 | -5 03 36.73 | 4.35 | -81 |
| 1144 | 1702 | μ Leporis | 3.31 | B9IV | 5 13 53.9 | 2.698 | +30 | -16 10 53.54 | 3.98 | -26 |
| 194 | 1713 | β Orionis* | 0.12 | B8 Iab | 5 15 34.3 | 2.887 | +0 | -8 10 42.04 | 3.86 | -1 |
| 193 | 1708 | α Aurigae* | 0.08 | G5IIIe+ | 5 18 16.9 | 4.444 | +72 | +46 01 03.24 | 3.20 | -425 |
| 195 | 1735 | τ Orionis | 3.60 | B5 III | 5 18 39.1 | 2.917 | -10 | -6 49 21.75 | 3.59 | -8 |
| 1147 | 1765 | 22 Orionis | 4.73 | B2IV-V | 5 22 51.7 | 3.067 | -0 | +0 21 46.55 | +3.23 | -1 |
| 201 | 1790 | γ Orionis* | 1.64 | B2 III | 5 26 17.1 | 3.222 | -6 | +6 22 02.68 | 2.92 | -14 |
| 202 | 1791 | β Tauri* | 1.65 | B7 III | 5 27 39.2 | 3.799 | +17 | +28 37 24.79 | 2.64 | -175 |
| 204 | 1829 | β Leporis | 2.84 | G5 II | 5 29 10.0 | 2.574 | -3 | -20 44 37.34 | 2.60 | -89 |
| 214 | 1953 | γ Mensae | 5.19 | K2 III | 5 31 02.5 | -2.340 | +321 | -76 19 28.06 | 2.81 | +282 |
| 206 | 1852 | δ Orionis* | 2.23 | O9.5 II+ | 5 33 06.4 | 3.069 | +1 | +0 17 05.45 | 2.34 | -2 |
| 207 | 1865 | α Leporis* | 2.58 | F0 Ib | 5 33 40.8 | 2.649 | +1 | -17 48 29.95 | +2.30 | +2 |
| 212 | 1922 | β Doradus | 3.76v | F6Ia | 5 33 48.9 | 0.528 | +3 | -62 28 33.99 | 2.29 | +9 |
| (GC) | 1879 | λ Orionis* | 3.54 | O8 III | 5 36 19.4 | 3.308 | -1 | +9 56 48.47 | 2.06 | -2 |
| 209 | 1899 | ι Orionis | 2.77 | O9 III | 5 36 29.1 | 2.938 | +0 | -5 53 50.47 | 2.05 | +1 |
| 210 | 1903 | ε Orionis* | 1.70 | B0 Iab | 5 37 18.3 | 3.048 | +1 | -1 11 23.45 | 1.98 | -2 |
| 211 | 1910 | ζ Tauri | 3.00 | B2IV | 5 38 55.9 | 3.590 | +0 | +21 09 13.37 | 1.82 | -21 |
| 215 | 1956 | α Columbae* | 2.64 | B7 IVe | 5 40 25.7 | 2.176 | +5 | -34 03 50.09 | +1.68 | -26 |
| 1154 | 2015 | δ Doradus | 4.35 | A7V | 5 44 48.8 | 0.114 | -49 | -65 43 39.21 | 1.34 | +8 |
| 217 | 1983 | γ Leporis | 3.60 | F6 V | 5 45 21.6 | 2.503 | -212 | -22 26 33.90 | 0.91 | -369 |
| 219 | 1998 | ζ Leporis | 3.55 | A2 IV-V(n) | 5 47 55.8 | 2.721 | -11 | -14 48 55.53 | 1.05 | -1 |
| 220 | 2004 | κ Orionis* | 2.06 | B0Iab | 5 48 46.6 | 2.848 | +1 | -9 39 48.75 | 0.98 | -2 |
| 223 | 2040 | β Columbae | 3.12 | K1 IIICN+1 | 5 51 43.1 | 2.119 | +49 | -35 45 41.28 | 1.13 | +401 |
| 222 | 2035 | δ Leporis | 3.81 | K1IVFe | 5 52 14.8 | 2.582 | +161 | -20 52 43.40 | +0.03 | -649 |
| 224 | 2061 | α Orionis* | 0.5 | M2Iab | 5 56 20.2 | 3.251 | +17 | +7 24 33.52 | +0.33 | +9 |

**No. 168 : *Aldebaran*, Rohini**
* **No. 183 : Mag. 2.9 to 3.8.**
**No. 188 : *Cursa*.**
**No. 194 : *Rigel.***
**No. 193 : *Capella*, Brahmahridaya.**
**No. 201 : *Bellatrix.***
**No. 202 : *El Nath*, Agni.**
**No. 206 : *Mintaka*.**
**No. 207 : *Arneb*.**
**No. GC : *Mrgasiras*.**
**No. 210 : *Alnilam.***
**No. 215 : *Phakt*.**
**No. 220 : *Saiph*.**
**No. 224 : *Betelgeuse*, Mag. 0.4 to 1.3 Ardra.**

## MEAN PLACES OF STARS, J 2021.5

FOR JULY 2$^d$.375 TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

| Cat. No. FK5 | BS =HR No. | Star | Mag. | Spectral Type | Right Ascension | Annual Variation | Annual Proper motion | Declination | Annual Variation | Annual Proper motion |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | h m s | s | s (0.0001) | ° ' " | " | " (0.001) |
| 226 | 2085 | η Leporis | 3.71 | F2 V | 5 57 23.1 | 2.735 | -28 | -14 09 55.04 | +0.37 | +139 |
| 229 | 2120 | η Columbae | 3.96 | K01II | 5 59 48.3 | 1.839 | +20 | -42 48 54.16 | 0.00 | -14 |
| 227 | 2088 | β Aurigae* | 1.90 | A2IV+ | 6 01 06.4 | 4.404 | -54 | +44 56 50.19 | -0.10 | 0 |
| 225 | 2077 | δ Aurigae* | 3.72 | K0 III | 6 01 17.9 | 4.943 | +92 | +54 17 01.47 | 0.24 | -126 |
| 1163 | 2134 | 1 Geminorum | 4.16 | G5III | 6 05 25.7 | 3.649 | -6 | +23 15 37.03 | 0.57 | -100 |
| 1168 | 2219 | κ Aurigae | 4.35 | G8.5IIIb | 6 16 44.9 | 3.823 | -57 | +29 29 17.14 | 1.73 | -262 |
| 240 | 2282 | ζ Canis Maj. | 3.02 | B2.5V | 6 21 08.4 | 2.306 | +7 | -30 04 27.12 | -1.84 | +3 |
| 243 | 2294 | β Canis Maj.* | 1.98 | B1 II/III | 6 23 38.8 | 2.644 | -4 | -17 58 04.86 | 2.06 | 0 |
| 241 | 2286 | μ Geminorum | 2.88 | M3 III | 6 24 15.7 | 3.630 | +39 | +22 30 02.09 | 2.23 | -111 |
| 245 | 2326 | α Carinae* | -0.72 | F0II | 6 24 25.8 | 1.333 | +25 | -52 42 29.45 | 2.11 | +21 |
| 244 | 2298 | 8ε Monocerotis | 4.44 | A5 IV | 6 24 54.5 | 3.181 | -12 | +4 34 48.80 | 2.16 | +11 |
| 1173 | 2343 | ν Geminorum | 4.15 | B6 IIIe | 6 30 14.4 | 3.562 | -5 | +20 11 47.76 | 2.65 | -14 |
| 252 | 2451 | ν Puppis | 3.17 | B8 III | 6 38 25.2 | 1.838 | +2 | -43 12 56.92 | -3.35 | -6 |
| 251 | 2421 | γ Geminorum* | 1.93 | A0 IV | 6 38 57.2 | 3.465 | +29 | +16 22 44.80 | 3.43 | -42 |
| 254 | 2473 | ε Geminorum | 2.98 | G8 Ib | 6 45 15.2 | 3.689 | -4 | +25 06 28.31 | 3.95 | -13 |
| 257 | 2491 | α Canis Maj* cg | -1.46 | A1V | 6 46 05.7 | 2.643 | -387 | -16 44 49.10 | 5.21 | -1204 |
| 256 | 2484 | ξGeminorum | 3.36 | F5 IV | 6 46 29.7 | 3.366 | -79 | +12 52 14.20 | 4.23 | -191 |
| 262 | 2550 | α Pictoris | 3.27 | A8VmkA6 | 6 48 24.6 | 0.612 | -96 | -61 57 53.31 | 3.93 | +269 |
| 263 | 2553 | τ Puppis | 2.93 | K1 III | 6 50 28.2 | 1.490 | +38 | -50 38 27.87 | -4.45 | -70 |
| 1180 | 2538 | κ Canis Maj. | 3.96 | B1.5IVe | 6 50 38.7 | 2.243 | -5 | -32 32 04.22 | 4.39 | +4 |
| 261 | 2540 | θ Geminorum | 3.60 | A3III | 6 54 12.3 | 3.949 | -2 | +33 55 59.73 | 4.74 | -48 |
| 268 | 2618 | ε Canis Maj.* | 1.50 | B2 Iab | 6 59 28.3 | 2.360 | +3 | -29 00 09.24 | 5.14 | +3 |
| 1183 | 2646 | σ Canis Maj. | 3.47 | M1.5Iab | 7 02 34.6 | 2.392 | -4 | -27 58 00.77 | 5.40 | +5 |
| 270 | 2653 | $o^2$ Canis Maj. | 3.02 | B3 Ia | 7 03 55.4 | 2.507 | -3 | -23 51 57.71 | 5.51 | +3 |
| 269 | 2650 | ζ Geminorum* | 3.79v | G0Ibv | 7 05 23.0 | 3.555 | -6 | +20 32 12.87 | -5.64 | 0 |
| 1189 | 2736 | $\gamma^2$ Volantis | 3.78 | K0III | 7 08 33.5 | -0.532 | +47 | -70 32 01.21 | 5.80 | +106 |
| 273 | 2693 | δ Canis Maj. | 1.86 | F8 Iab | 7 09 16.0 | 2.441 | -2 | -26 25 42.93 | 5.96 | +4 |
| 1187 | 2714 | 22δ Monocerotis | 4.15 | A2V | 7 12 57.7 | 3.064 | -1 | +0 31 47.77 | 6.27 | +5 |
| 281 | 2803 | δ Volantis | 3.98 | F6II | 7 16 48.8 | -0.048 | -12 | -67 59 47.67 | 6.59 | +5 |
| 278 | 2773 | π Puppis | 2.70 | K3Ib | 7 17 54.1 | 2.121 | -8 | -37 08 13.98 | 6.68 | +4 |
| 277 | 2763 | λ Geminorum | 3.58 | A3V | 7 19 19.6 | 3.444 | -33 | +16 29 59.43 | -6.84 | -37 |
| 279 | 2777 | δ Geminorum | 3.53 | F0 IV | 7 21 24.3 | 3.578 | -19 | +21 56 27.30 | 6.98 | -12 |
| 283 | 2827 | η Canis Maj. | 2.45 | B5 Ia | 7 24 56.8 | 2.375 | -3 | -29 20 46.45 | 7.25 | +5 |
| 282 | 2821 | ι Geminorum | 3.79 | G9 IIIb | 7 27 03.6 | 3.719 | -93 | +27 45 12.52 | 7.52 | -86 |
| 285 | 2845 | β Canis Min.* | 2.90 | B8Ve | 7 28 19.0 | 3.251 | -35 | +8 14 39.72 | 7.57 | -38 |
| 1194 | 2878 | ρ Puppis | 3.25 | K5 III | 7 29 54.8 | 1.905 | -50 | -43 20 45.43 | 7.48 | +187 |
| 287 | 2891 | α Gemino.* *cg* | 1.95 | A2Vm | 7 35 58.2 | 3.820 | -135 | +31 50 22.38 | -8.25 | -98 |
| 291 | 2943 | α C. Min.* *cg* | 0.38 | F5 IV-V | 7 40 25.6 | 3.137 | -477 | +5 10 06.20 | 9.53 | -1022 |
| 297 | 3024 | ζ Volantis | 3.95 | K0III | 7 41 32.5 | -0.783 | +67 | -72 39 26.42 | -8.57 | +18 |

* **No. 225 : Prajapati.**
**No. 227 : *Menkalinam* .**
**No. 243 : *Mirzam.***
**No. 245 : *Canopus* , Agastya.**
**No. 251 : *Alhena* .**

**No. 257 : *Sirius* , Lubdhaka Mag. - 1.46.**
**No. 268 : *Adhara.***
**No. 269 : Mekbuda Mag. 3.7 to 4.1.**
**No. 285 : *Gomeisa.***
**No. 287 : *Castor,* Punarvasu-2, Mag. 1.95 &**
**No. 291 : *Procyon* , Mag. 0.38 & 11.3.**

## MEAN PLACES OF STARS, J 2021.5

FOR JULY 2$^{d}$.375 TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

| Cat. No. FK5 | BS =HR No. | Star | Mag. | Spectral Type | Right Ascension | Annual Variation | Annual Proper motion | Declination | Annual Variation | Annual Proper motion |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | h m s | s | s (0.0001) | ° ' " | " | " (0.001) |
| 293 | 2970 | 26α Monocerotis | 3.93 | G9 III | 7 42 16.5 | 2.867 | -49 | -9 36 09.71 | -8.67 | -19 |
| 294 | 2985 | κ Geminorum | 3.57 | G8 III | 7 45 44.6 | 3.614 | -24 | +24 20 40.85 | 8.97 | -52 |
| 295 | 2990 | β Geminorum* | 1.14 | K0IIIb | 7 46 37.7 | 3.662 | -474 | +27 58 21.06 | 9.04 | -45 |
| 1204 | 3045 | ξ Puppis | 3.34 | G6 Ia | 7 50 11.9 | 2.525 | -2 | -24 54 53.90 | 9.27 | -2 |
| 301 | 3080 | 213 G. Puppis | 3.73 | K1/2II+ | 7 52 57.4 | 2.065 | -8 | -40 37 56.30 | 9.48 | +3 |
| 303 | 3117 | χ Carinae | 3.47 | B3IVp | 7 57 19.5 | 1.524 | -32 | -53 02 26.61 | 9.80 | +21 |
| 306 | 3165 | ζ Puppis | 2.25 | O4If(m)p | 8 04 20.4 | 2.111 | -24 | -40 03 53.25 | -10.34 | +12 |
| 308 | 3185 | ρ Puppis | 2.81 | F6IIp | 8 08 27.6 | 2.557 | -61 | -24 22 02.74 | 10.61 | +49 |
| 309 | 3207 | γ² Velorum | 1.78 | WC8+O7.5 | 8 10 11.7 | 1.850 | -4 | -47 24 03.09 | 10.78 | +6 |
| 312 | 3249 | β Cancri | 3.52 | K 3:IIIv | 8 17 40.8 | 3.249 | -30 | +9 07 04.18 | 11.38 | -49 |
| 315 | 3307 | ε Carinae | 1.86 | K2III | 8 22 57.2 | 1.225 | -35 | -59 34 45.55 | 11.69 | +14 |
| 319 | 3347 | β Volantis | 3.77 | K2 III | 8 25 57.9 | 0.633 | -60 | -66 12 32.44 | 12.07 | -155 |
| 316 | 3314 | Br 1197 Hydrae | 3.90 | A0V | 8 26 44.1 | 2.996 | -44 | -3 58 40.25 | -12.00 | -23 |
| 317 | 3323 | *o* Ursae Maj. | 3.36 | G5 III | 8 32 02.0 | 4.929 | -182 | +60 38 39.11 | 12.45 | -107 |
| 321 | 3366 | η Cancri | 5.33 | K3 III | 8 33 56.9 | 3.460 | -34 | +20 21 59.96 | 12.52 | -43 |
| 1223 | 3410 | δ Hydrae | 4.16 | A1Vnn | 8 38 47.6 | 3.172 | -44 | +5 37 38.88 | 12.81 | -7 |
| 1224 | 3418 | σ Hydrae | 4.44 | K1 III | 8 39 52.8 | 3.133 | -12 | +3 15 52.58 | 12.89 | -18 |
| 1227 | 3447 | *o* Velorum | 3.62 | B3 IV | 8 40 54.6 | 1.719 | -24 | -52 59 56.53 | 12.92 | +20 |
| 1226 | 3445 | 53 G. Velorum | 3.84 | F3 Ia | 8 41 20.5 | 1.994 | +0 | -46 43 33.90 | -12.97 | +3 |
| 327 | 3468 | α Pyxidis | 3.68 | B1.5 III | 8 44 27.4 | 2.414 | -9 | -33 15 53.52 | 13.17 | +11 |
| 1228 | 3449 | γ Cancri | 4.66 | A1IV | 8 44 31.6 | 3.462 | -76 | +21 23 23.11 | 13.22 | -39 |
| 326 | 3461 | δ Cancri* | 3.94 | K0 III | 8 45 54.2 | 3.401 | -13 | +18 04 26.01 | 13.50 | -228 |
| (329) | 3482 | ε Hydrae* m | 3.38 | G5III | 8 47 54.7 | 3.170 | -155 | +6 20 19.44 | 13.44 | -40 |
| 328 | 3475 | ι Cancri | 4.02 | G8Iab | 8 47 59.6 | 3.617 | -19 | +28 40 47.35 | 13.45 | -42 |
| 336 | 3571 | 108 G. Carinae | 3.84 | B8.5II | 8 55 32.0 | 1.355 | -28 | -60 43 38.29 | -13.85 | +38 |
| 334 | 3547 | ζ Hydrae | 3.11 | G9 II-III | 8 56 31.7 | 3.167 | -66 | +5 51 44.91 | 13.94 | +15 |
| 337 | 3572 | α Cancri* | 4.25 | A5 m | 8 59 39.7 | 3.275 | +23 | +11 46 23.66 | 14.18 | -31 |
| 335 | 3569 | ι Ursae Maj. | 3.14 | A7 V | 9 00 40.2 | 4.076 | -443 | +47 57 20.62 | 14.44 | -225 |
| 342 | 3614 | 97 G. Velorum | 3.75 | K2 III | 9 04 53.9 | 2.073 | -44 | -47 11 02.93 | 14.48 | -13 |
| 341 | 3594 | κ Ursae Maj. | 3.60 | A1Vn | 9 05 05.0 | 4.065 | -32 | +47 04 11.97 | 14.54 | -54 |
| 345 | 3634 | λ Velorum | 2.21 | K4 Ib-II | 9 08 47.3 | 2.212 | -17 | -43 31 12.75 | -14.69 | +13 |
| 1239 | 3627 | ξ Cancri | 5.14 | G9 III | 9 10 35.5 | 3.438 | +1 | +21 57 26.00 | 14.81 | +5 |
| 348 | 3685 | β Carinae | 1.68 | A2IV | 9 13 25.6 | 0.630 | -311 | -69 48 21.50 | 14.87 | +108 |
| 347 | 3665 | θ Hydrae | 3.88 | B9.5 V | 9 15 28.9 | 3.118 | +86 | +2 13 20.69 | 15.41 | -310 |
| 351 | 3699 | ι Carinae | 2.25 | A8 Ib | 9 17 39.9 | 1.605 | -26 | -59 21 57.77 | 15.21 | +8 |
| 352 | 3705 | α Lyncis | 3.13 | K7 III | 9 22 21.5 | 3.636 | -179 | +34 18 01.45 | 15.47 | +19 |
| 1243 | 3718 | θ Pyxidis | 4.72 | M0 III | 9 22 26.8 | 2.660 | -8 | -26 03 28.31 | -15.50 | -8 |
| 353 | 3734 | κ Velorum* | 2.50 | B2 IV-V | 9 22 46.8 | 1.861 | -10 | -55 06 11.44 | 15.50 | +9 |
| 354 | 3748 | α Hydrae* | 1.98 | K3 II-III | 9 28 38.6 | 2.948 | -9 | -8 45 10.14 | 15.79 | +33 |
| 361 | 3803 | N Velorum | 3.13 | K5 III | 9 31 52.6 | 1.826 | -39 | -57 07 47.39 | 16.00 | +4 |
| 355 | 3757 | 23 Ursae Maj. | 3.67 | F0 IV | 9 33 12.1 | 4.656 | +160 | +62 57 58.74 | 16.04 | +27 |
| 358 | 3775 | θ Ursae Maj. | 3.17 | F7V | 9 34 17.0 | 3.973 | -1024 | +51 34 41.07 | -16.65 | -530 |

* **No. 295 : *Pollux*, Punarvasu-1.**
**No. 326 : Pusya.**
**No. 329 : Aslesa.**
**No. 337 : Acubens. (Aslesa.)**
**No. 353 : *Markeb*.**
**No. 354 : *Alphard*.**

## MEAN PLACES OF STARS, J 2021.5

FOR JULY $2^d.375$ TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

| Cat. No. FK5 | BS =HR No. | Star | Mag. | Spectral Type | Right Ascension | | | Annual Variation | Annual Proper motion | Declination | | | Annual Variation | Annual Proper motion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | h | m | s | s | s (0.0001) | ° | ' | " | " | " (0.001) |
| 1250 | 3845 | ι Hydrae | 3.91 | K2.5 III | 9 | 40 | 57.2 | 3.062 | +32 | -1 | 14 | 29.17 | -16.53 | -64 |
| 364 | 3849 | κ Hydrae | 5.06 | B4IV/V | 9 | 41 | 20.2 | 2.878 | -19 | -14 | 25 | 50.68 | 16.50 | -20 |
| 365 | 3852 | *o* Leonis | 3.52 | F5I+ | 9 | 42 | 17.8 | 3.196 | -96 | +9 | 47 | 36.68 | 16.57 | -37 |
| 367 | 3873 | ε Leonis | 2.98 | G1 II | 9 | 47 | 04.1 | 3.393 | -34 | +23 | 40 | 27.17 | 16.77 | -11 |
| 368 | 3888 | *ν* Ursae Maj. | 3.80 | F2 IV | 9 | 52 | 30.0 | 4.209 | -379 | +58 | 56 | 11.03 | 17.17 | -151 |
| 371 | 3905 | μ Leonis | 3.88 | K2 III | 9 | 53 | 58.9 | 3.398 | -160 | +25 | 54 | 16.93 | 17.14 | -56 |
| 375 | 3940 | φVelorum | 3.54 | B5 Ib | 9 | 57 | 37.2 | 2.115 | -12 | -54 | 40 | 14.65 | -17.25 | +3 |
| 1261 | 3970 | *ν*´ Hydrae | 4.60 | B8 V | 10 | 06 | 10.3 | 2.924 | -25 | -13 | 10 | 10.84 | 17.60 | +18 |
| 379 | 3975 | η Leonis | 3.52 | A0 Ib | 10 | 08 | 30.1 | 3.262 | -1 | +16 | 39 | 25.14 | 17.72 | 0 |
| 380 | 3982 | α Leonis* | 1.35 | B7 V | 10 | 09 | 30.9 | 3.189 | -169 | +11 | 51 | 40.73 | 17.75 | +7 |
| 381 | 3994 | λ Hydrae | 3.61 | K0IIICN+1 | 10 | 11 | 38.2 | 2.927 | -138 | -12 | 27 | 39.80 | 17.93 | -88 |
| 385 | 4037 | ω Carinae | 3.32 | B8 IIIe | 10 | 14 | 14.8 | 1.420 | -76 | -70 | 08 | 42.04 | 17.94 | +7 |
| 382 | 4023 | 191 G.Velorum | 3.85 | A2 Va | 10 | 15 | 38.5 | 2.529 | -131 | -42 | 13 | 44.99 | -17.95 | +45 |
| 1264 | 4050 | 187 G. Carinae | 3.40 | K3 II a | 10 | 17 | 48.2 | 2.013 | -34 | -61 | 26 | 24.75 | 18.08 | +5 |
| 384 | 4031 | ζ Leonis | 3.44 | F0 III | 10 | 17 | 52.9 | 3.325 | +13 | +23 | 18 | 33.76 | 18.09 | -7 |
| 383 | 4033 | λ Ursae Maj. | 3.45 | A2 IV | 10 | 18 | 23.1 | 3.591 | -149 | +42 | 48 | 22.28 | 18.14 | -38 |
| 1268 | 4080 | 204 G.Velorum | 4.83 | K1 III | 10 | 23 | 15.1 | 2.585 | -20 | -41 | 45 | 31.74 | 18.23 | +56 |
| 386 | 4069 | μ Ursae Maj. | 3.05 | M0 III | 10 | 23 | 36.1 | 3.549 | -72 | +41 | 23 | 26.14 | 18.26 | +35 |
| 391 | 4102 | I Carinae | 4.00 | F3 V | 10 | 24 | 48.9 | 1.172 | -52 | -74 | 08 | 28.48 | -18.36 | -26 |
| 389 | 4094 | μ Hydrae | 3.81 | K4III | 10 | 27 | 07.9 | 2.906 | -89 | -16 | 56 | 48.19 | 18.50 | -80 |
| 392 | 4104 | α Antliae | 4.25 | K4 III | 10 | 28 | 08.3 | 2.754 | -58 | -31 | 10 | 40.27 | 18.44 | +11 |
| 393 | 4114 | 196 G. Carinae | 3.82 | F2II | 10 | 28 | 40.3 | 2.216 | -17 | -58 | 50 | 58.96 | 18.47 | 0 |
| 1270 | 4116 | δ Sextantis | 5.21 | B9.5 V | 10 | 30 | 34.2 | 3.047 | -32 | -2 | 50 | 59.26 | 18.55 | -14 |
| 397 | 4140 | 203 G. Carinae | 3.32 | B4 Vne | 10 | 32 | 47.6 | 2.147 | -27 | -61 | 47 | 46.95 | 18.60 | +9 |
| 396 | 4133 | ρ Leonis | 3.85 | B1 Iab | 10 | 33 | 56.5 | 3.154 | -4 | +9 | 11 | 43.11 | -18.65 | -3 |
| 401 | 4174 | γ Chamaeleontis | 4.11 | M0 III | 10 | 35 | 42.3 | 0.653 | -143 | -78 | 43 | 09.67 | 18.69 | +14 |
| 406 | 4199 | θ Carinae | 2.76 | B0Vp | 10 | 43 | 43.7 | 2.156 | -35 | -64 | 30 | 26.89 | 18.93 | +10 |
| 411 | 4234 | δ´ Chamaeleontis | 4.45 | B2.5 IV | 10 | 45 | 57.4 | 0.478 | -201 | -80 | 39 | 13.04 | 19.00 | +8 |
| 410 | 4232 | ν Hydrae | 3.11 | K0/K1III | 10 | 50 | 41.2 | 2.965 | +66 | -16 | 18 | 24.01 | 18.93 | +200 |
| 412 | 4247 | 46 Leonis Min. | 3.83 | K0IIIV | 10 | 54 | 30.5 | 3.337 | +70 | +34 | 05 | 54.44 | 19.51 | -279 |
| 1283 | 4287 | α Crateris | 4.08 | K1III | 11 | 00 | 49.4 | 2.929 | -323 | -18 | 24 | 49.22 | -19.25 | +130 |
| 416 | 4295 | β Ursae Maj.* | 2.37 | A1V | 11 | 03 | 07.5 | 3.577 | +99 | +56 | 15 | 59.97 | 19.39 | +34 |
| 417 | 4301 | α Ursae Maj.* | 1.80 | K0 Iab | 11 | 05 | 02.2 | 3.646 | -167 | +61 | 38 | 03.51 | 19.53 | -66 |
| 1289 | 4337 | 260 G. Carinae | 3.91 | G0Iab | 11 | 09 | 30.9 | 2.587 | -9 | -59 | 05 | 30.55 | 19.56 | 0 |
| 420 | 4335 | ψ Ursae Maj. | 3.01 | K1 III | 11 | 10 | 51.8 | 3.348 | -60 | +44 | 22 | 53.21 | 19.61 | -28 |
| 422 | 4357 | δ Leonis* | 2.56 | A4V | 11 | 15 | 14.9 | 3.182 | +101 | +20 | 24 | 20.00 | 19.79 | -130 |
| 423 | 4359 | θ Leonis* | 3.34 | A2V | 11 | 15 | 22.0 | 3.142 | -42 | +15 | 18 | 42.12 | -19.74 | -79 |
| 425 | 4377 | ν Ursae Maj. | 3.48 | K3 III | 11 | 19 | 38.1 | 3.225 | -20 | +32 | 58 | 36.00 | 19.70 | +28 |
| 426 | 4382 | δ Crateris | 3.56 | K0III | 11 | 20 | 25.1 | 3.006 | -84 | -14 | 53 | 42.69 | 19.54 | +208 |
| 433 | 4434 | λ Draconis | 3.84 | M0 III | 11 | 32 | 39.4 | 3.487 | -73 | +69 | 12 | 43.80 | 19.92 | -17 |
| 434 | 4450 | ξ Hydrae | 3.54 | G7 III | 11 | 34 | 03.8 | 2.965 | -162 | -31 | 58 | 36.40 | 19.95 | -39 |
| 436 | 4467 | λ Centauri | 3.13 | B9III | 11 | 36 | 47.0 | 2.802 | -61 | -63 | 08 | 20.03 | -19.94 | -5 |

* **No. 380 : *Regulus*, Magha.**
**No. 416 : *Merak*, Pulaha.**
**No. 417 : *Dubhe*, Kratu.**
**No. 422 : *Zosma*, Purva Phalguni-1.**
**No. 423 : Purva Phalguni-2.**

## MEAN PLACES OF STARS, J 2021.5

FOR JULY $2^d.375$ TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

| Cat. No. FK5 | BS =HR No. | Star | Mag. | Spec-tral Type | Right Ascension | | | Annual Variation | Annual Proper motion | Declination | | | Annual Variation | Annual Proper motion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | h | m | s | s | s (0.0001) | ° | ' | " | " | " (0.001) |
| 442 | 4520 | λ Muscae | 3.64 | A7 V | 11 | 46 | 38.1 | 2.876 | -174 | -66 | 50 | 52.79 | -19.97 | +37 |
| 441 | 4518 | χ Ursae Maj. | 3.71 | K0.5 IIIb | 11 | 47 | 10.7 | 3.144 | -136 | +47 | 39 | 36.36 | 19.98 | +30 |
| 1304 | 4527 | 93 Leonis* | 4.53v | A7V+ | 11 | 49 | 05.5 | 3.088 | -106 | +20 | 05 | 57.68 | 20.02 | -3 |
| 444 | 4534 | β Leonis* | 2.14 | A3 V | 11 | 50 | 09.3 | 3.056 | -342 | +14 | 27 | 06.43 | 20.14 | -114 |
| 445 | 4540 | β Virginis | 3.61 | F9 V | 11 | 51 | 48.9 | 3.126 | +495 | +1 | 38 | 36.44 | 20.30 | -271 |
| 447 | 4554 | γ Ursae Maj.* | 2.44 | A0 Ve | 11 | 54 | 57.1 | 3.126 | +107 | +53 | 34 | 30.60 | 20.02 | +12 |
| 452 | 4621 | δ Centauri | 2.60 | B2 IV ne | 12 | 09 | 28.9 | 3.140 | -36 | -50 | 50 | 31.50 | -20.03 | -8 |
| 453 | 4630 | ε Corvi | 3.00 | K2III | 12 | 11 | 14.0 | 3.098 | -51 | -22 | 44 | 21.30 | 20.00 | +13 |
| 455 | 4656 | δ Crucis | 2.80 | B2 IV | 12 | 16 | 17.9 | 3.227 | -53 | -58 | 52 | 06.16 | 20.00 | -9 |
| 456 | 4660 | δ Ursae Maj.* | 3.31 | A3 V | 12 | 16 | 28.9 | 2.941 | +127 | +56 | 54 | 47.76 | 19.98 | +9 |
| 457 | 4662 | γ Corvi* | 2.59 | B8III | 12 | 16 | 54.9 | 3.095 | -112 | -17 | 39 | 40.28 | 19.96 | +23 |
| 459 | 4674 | β Chamaeleontis | 4.26 | B5 Vn | 12 | 19 | 39.1 | 3.671 | -174 | -79 | 25 | 52.98 | 19.95 | +17 |
| 460 | 4689 | η Virginis | 3.89 | A2 IV+ | 12 | 21 | 00.4 | 3.073 | -42 | +0 | 47 | 10.09 | -19.98 | -18 |
| 462 | 4730 | α Crucis*A | 1.33 | B0.5 IV | 12 | 27 | 48.6 | 3.391 | -53 | -63 | 13 | 04.71 | 19.91 | -12 |
| 465 | 4757 | δ Corvi* | 2.95 | A0IV(m)kB9 | 12 | 30 | 58.8 | 3.115 | -146 | -16 | 38 | 05.65 | 20.00 | -138 |
| 468 | 4763 | γ Crucis | 1.63v | M3.5 III | 12 | 32 | 22.3 | 3.370 | +29 | -57 | 13 | 59.91 | 20.10 | -262 |
| 469 | 4773 | γ Muscae | 3.87 | B5V | 12 | 33 | 46.7 | 3.676 | -126 | -72 | 15 | 05.10 | 19.83 | -2 |
| 472 | 4787 | κ Draconis | 3.87v | B6IIIp | 12 | 34 | 23.4 | 2.525 | -112 | +69 | 40 | 11.68 | 19.80 | +12 |
| 471 | 4786 | β Corvi | 2.65 | G5 II | 12 | 35 | 31.3 | 3.165 | +2 | -23 | 30 | 55.37 | -19.85 | -54 |
| 474 | 4798 | α Muscae | 2.69 | B2 IV-V | 12 | 38 | 29.3 | 3.656 | -90 | -69 | 15 | 13.28 | 19.77 | -13 |
| 475 | 4813 | χ Virginis | 4.66 | K2 III | 12 | 40 | 21.5 | 3.104 | -51 | -8 | 06 | 49.19 | 19.76 | -25 |
| 1326 | 4828 | ρ Virginis | 4.88 | A0 V | 12 | 42 | 58.4 | 3.037 | +57 | +10 | 07 | 02.65 | 19.78 | -90 |
| 481 | 4853 | β Crucis | 1.25 | B0.5 IV | 12 | 48 | 59.5 | 3.556 | -63 | -59 | 48 | 21.10 | 19.60 | -14 |
| 483 | 4905 | ε Ursae Maj.* | 1.77 | A0p | 12 | 54 | 58.2 | 2.621 | +132 | +55 | 50 | 36.57 | 19.47 | -6 |
| 484 | 4910 | δ Virginis* | 3.38 | M3III | 12 | 56 | 41.2 | 3.025 | -313 | +3 | 16 | 51.55 | -19.49 | -54 |
| 485 | 4915 | α CVn sq* | 2.90 | A0spe | 12 | 57 | 01.8 | 2.797 | -198 | +38 | 12 | 09.56 | 19.37 | +56 |
| 488 | 4932 | ε Virginis* | 2.83 | G8 III | 13 | 03 | 14.8 | 2.987 | -185 | +10 | 50 | 38.43 | 19.26 | +20 |
| 487 | 4923 | δ Muscae | 3.62 | K2 III | 13 | 03 | 47.0 | 4.237 | +543 | -71 | 39 | 51.04 | 19.29 | -20 |
| 492 | 4983 | β Com | 4.26 | G0 V | 13 | 12 | 52.5 | 2.795 | -604 | +27 | 46 | 10.75 | 18.16 | +881 |
| 495 | 5020 | γ Hydrae | 3.00 | G8 III | 13 | 20 | 05.7 | 3.277 | +47 | -23 | 17 | 03.86 | 18.87 | -45 |
| 496 | 5028 | ι Centauri | 2.75 | kA15hA3nA3va | 13 | 21 | 48.8 | 3.397 | -284 | -36 | 49 | 30.30 | -18.86 | -86 |
| 497 | 5054 | ζ Ursae Maj.*pr | 2.27 | A2V | 13 | 24 | 47.3 | 2.404 | +141 | +54 | 48 | 48.91 | 18.71 | -20 |
| 498 | 5056 | α Virginis* | 0.98 | B1 III-IV+ | 13 | 26 | 19.7 | 3.171 | -28 | -11 | 16 | 22.41 | 18.66 | -28 |
| 501 | 5107 | ζ Virginis | 3.37 | A3V | 13 | 35 | 47.4 | 3.063 | -190 | +0 | 42 | 18.72 | 18.27 | +42 |
| 504 | 5132 | ε Centauri | 2.30 | B1 III | 13 | 41 | 15.8 | 3.846 | -32 | -53 | 34 | 29.42 | 18.13 | -17 |
| 509 | 5191 | η Ursae Maj.* | 1.86 | B3 V | 13 | 48 | 23.1 | 2.358 | -125 | +49 | 12 | 23.74 | 17.85 | -11 |
| 508 | 5193 | μ Centauri | 3.04 | B2Vmpe | 13 | 50 | 55.3 | 3.645 | -21 | -42 | 34 | 47.94 | -17.76 | -20 |
| 513 | 5235 | η Bootis | 2.68 | G0 IV | 13 | 55 | 42.5 | 2.857 | -44 | +18 | 17 | 26.41 | 17.90 | -358 |
| 512 | 5231 | ζ Centauri | 2.55 | B2.5 IV | 13 | 56 | 53.5 | 3.779 | -56 | -47 | 23 | 35.72 | -17.53 | -42 |

* **No. 1304 : Uttara Phalguni-2.**
**No. 444 : *Denebola,* Uttara Phalguni-1.**
**No. 447 : *Phecda or Phad,* Pulastya.**
**No. 456 : *Megrez,* Atri.**
**No. 457 : *Minkar.***
**No. 462 : *Acrux*.**
**No. 465 : *Algorel*, Hasta.**
**No. 483 : *Alioth,* Angira.**
**No. 484 : Minelauva.**
**No. 485 : 12 Canum Venaticorum, Mag. *p* 2.9**
**No. 488 : *Vindemiatrix.***
**No. 497 : *Mizar*, Vasista. Mag. *f*. 4.0.**
**No. 498 : *Spica*, Citra.**
**No. 509 : *Alkaid, Benetnasch,* Marichi.**

## MEAN PLACES OF STARS, J 2021.5

FOR JULY $2^d.375$ TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

| Cat. No. FK5 | BS =HR No. | Star | Mag. | Spec- tral Type | Right Ascension | Annual Variation | Annual Proper motion | Declination | Annual Variation | Annual Proper motion |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | h m s | s | s (0.0001) | ° ' " | " | " (0.001) |
| 521 | 5291 | α Draconis* | 3.65 | A0 III | 14 04 58.3 | 1.629 | -84 | +64 16 24.74 | -17.12 | +18 |
| 518 | 5267 | β Centauri* | 0.61 | B1 III | 14 05 21.6 | 4.298 | -43 | -60 28 31.99 | 17.14 | -19 |
| 519 | 5287 | π Hydrae | 3.27 | K1III-IV | 14 07 36.1 | 3.435 | +33 | -26 47 05.94 | 17.15 | -139 |
| 520 | 5288 | θ Centauri | 2.06 | K0 III | 14 07 57.3 | 3.556 | -429 | -36 28 29.30 | 17.52 | -520 |
| 523 | 5315 | κ Virginis | 4.19 | K2.5 III | 14 14 02.8 | 3.211 | +5 | -10 22 22.30 | 16.57 | +140 |
| 526 | 5340 | α Bootis* | -0.04 | K1.5 III | 14 16 38.6 | 2.739 | -769 | +19 04 16.65 | 18.58 | -2000 |
| 525 | 5338 | ι Virginis | 4.08 | F7IV | 14 17 08.7 | 3.156 | -2 | -6 06 07.95 | -16.99 | -432 |
| 1371 | 5359 | λ Virginis | 4.52 | A1V | 14 20 16.6 | 3.258 | -11 | -13 28 08.65 | 16.37 | +30 |
| 531 | 5404 | θ Bootis | 4.05 | F7 V | 14 25 55.7 | 2.042 | -253 | +51 45 07.35 | 16.51 | -398 |
| 534 | 5429 | ρ Bootis | 3.58 | K3 III | 14 32 45.4 | 2.585 | -77 | +30 16 40.47 | 15.63 | +119 |
| 535 | 5435 | γ Bootis | 3.03 | A7 III | 14 32 56.6 | 2.415 | -97 | +38 12 54.06 | 15.59 | +153 |
| 537 | 5440 | η Centauri | 2.31 | B1.5 IVne | 14 36 52.9 | 3.840 | -31 | -42 15 03.78 | 15.56 | -35 |
| 538 | 5460 | α Centauri* cg | 0.00 | G + | 14 41 04.5 | 4.129 | -4998 | -60 55 22.17 | -14.60 | +692 |
| 541 | 5469 | α Lupi | 2.30 | B1.5 III | 14 43 22.2 | 4.026 | -21 | -47 28 44.77 | 15.18 | -18 |
| 545 | 5487 | μ Virginis | 3.88 | F2 V | 14 44 11.8 | 3.171 | +73 | -5 45 02.02 | 15.43 | -316 |
| 539 | 5463 | α Circini | 3.19 | A 7VpSrCrEu | 14 44 16.2 | 4.933 | -302 | -65 04 01.46 | 15.34 | -232 |
| 544 | 5485 | 371 G.Cen | 4.05 | K5 III | 14 44 58.8 | 3.693 | -52 | -35 15 54.06 | 15.25 | -180 |
| 547 | 5511 | 109 Virginis | 3.72 | A0 V | 14 47 20.3 | 3.040 | -76 | +1 48 11.85 | 14.96 | -27 |
| 542 | 5470 | α Apodis | 3.83 | K2.5 III | 14 50 38.0 | 7.788 | -41 | -79 08 00.14 | -14.75 | -16 |
| 550 | 5563 | β Ursae Min.* | 2.08 | K4 III | 14 50 39.9 | -0.104 | -76 | +74 04 03.21 | 14.72 | +12 |
| 548 | 5531 | $\alpha^2$Librae* | 2.75 | A2HA5MA4IV | 14 52 04.3 | 3.332 | -73 | -16 07 47.68 | 14.72 | -67 |
| 552 | 5571 | β Lupi | 2.68 | B2 III | 14 59 57.0 | 3.960 | -32 | -43 13 08.95 | 14.21 | -39 |
| 553 | 5576 | κ Centauri | 3.13 | B2 IV | 15 00 34.1 | 3.932 | -17 | -42 11 20.77 | 14.16 | -24 |
| 555 | 5602 | β Bootis | 3.50 | G8 IIIa | 15 02 45.4 | 2.261 | -36 | +40 18 23.95 | 14.03 | -28 |
| 556 | 5603 | σ Librae | 3.29 | M3/M4III | 15 05 20.0 | 3.528 | -54 | -25 21 54.43 | -13.88 | -43 |
| 559 | 5652 | ι Librae* | 4.54 | B9IV pSc | 15 13 27.1 | 3.434 | -25 | -19 52 18.26 | 13.35 | -39 |
| 558 | 5649 | ζ Lupi | 3.41 | G7 III | 15 13 50.5 | 4.352 | -122 | -52 10 45.79 | 13.36 | -73 |
| 563 | 5681 | δ Bootis | 3.47 | G8 III | 15 16 22.2 | 2.421 | +69 | +33 14 08.10 | 13.24 | -112 |
| 564 | 5685 | β Librae* | 2.61 | B8 IV | 15 18 10.0 | 3.238 | -65 | -9 27 39.39 | 13.02 | -19 |
| 560 | 5671 | γ Tr. Austrini | 2.89 | A1 IV | 15 20 56.9 | 5.704 | -132 | -68 45 24.13 | 12.85 | -31 |
| 569 | 5735 | γ Ursae Min. | 3.05 | A 3 Iab | 15 20 42.7 | -0.042 | -40 | +71 45 26.98 | -12.81 | +20 |
| 1402 | 5695 | δ Lupi | 3.22 | B1.5 IV | 15 22 47.5 | 3.964 | -13 | -40 43 25.93 | 12.72 | -26 |
| 566 | 5705 | φ' Lupi | 3.56 | K5 III | 15 23 10.6 | 3.830 | -74 | -36 20 16.22 | 12.75 | -84 |
| 571 | 5744 | ι Draconis | 3.29 | K2 III | 15 25 24.7 | 1.345 | -12 | +58 53 28.74 | 12.50 | +17 |
| 572 | 5747 | β Cr. Borealis | 3.68 | F0p | 15 28 43.0 | 2.476 | -137 | +29 01 57.55 | 12.20 | +86 |
| 578 | 5793 | α Cr.Borealis* | 2.23 | A0 V | 15 35 35.9 | 2.543 | +91 | +26 38 36.46 | 11.90 | -88 |
| 577 | 5787 | γ Librae | 3.91 | K0III | 15 36 43.9 | 3.367 | +45 | -14 51 35.29 | -11.72 | +9 |
| 579 | 5794 | ν Librae | 3.58 | K5 III | 15 38 20.1 | 3.659 | -7 | -28 12 16.81 | 11.61 | +3 |
| 1413 | 5838 | κ Librae | 4.74 | K5III | 15 43 11.4 | 3.469 | -26 | -19 44 49.28 | 11.37 | -103 |
| 582 | 5854 | α Serpentis* | 2.65 | K2 III b | 15 45 19.7 | 2.961 | +92 | +6 21 33.60 | -11.06 | +47 |

* **No. 518 :** ***Agena*** **.**
**No. 521 :** ***Thuban*** **.**
**No. 526 :** ***Arcturus*** **, Svati.**
**No. 538 : Rigil** ***Kentaurus*** **Mag. 0.33 & 1.70.**
**No. 548 :** ***Zuben el Genubi,*** **Visakha.**
**No. 550 :** ***Kochab*** **.**
**No. 559 : Visakha.**
**No. 564 :** ***Zuben es Chamali.***
**No. 578 :** ***Margarita, Alphecca.***
**No. 582 :** ***Unukalhaly.***

# MEAN PLACES OF STARS, J 2021.5

FOR JULY 2$^{d}$.375 TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

| Cat. No. FK5 | BS =HR No. | Star | Mag. | Spec-tral Type | Right Ascension | Annual Variation | Annual Proper motion | Declination | Annual Variation | Annual Proper motion |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | h m s | s | s (0.0001) | ° ' " | " | " (0.001) |
| 583 | 5867 | β Serpentis | 3.67 | A3V | 15 47 10.9 | 2.773 | +46 | +15 21 20.83 | -11.02 | -45 |
| 585 | 5881 | μ Serpentis | 3.54 | A0 V | 15 50 44.7 | 3.139 | -57 | -3 29 40.56 | 10.74 | -24 |
| 588 | 5892 | ε Serpentis | 3.71 | A2 m | 15 51 53.4 | 2.996 | +86 | +4 24 51.82 | 10.57 | +63 |
| 589 | 5897 | β Tr.Australis | 2.85 | F1V | 15 57 03.4 | 5.350 | -283 | -63 29 40.70 | 10.64 | -398 |
| 591 | 5933 | γ Serpentis | 3.85 | F6 V | 15 57 26.9 | 2.776 | +217 | +15 35 33.94 | 11.49 | -1281 |
| 592 | 5944 | π Scorpii | 2.89 | B1 V+ | 16 00 09.4 | 3.643 | -8 | -26 10 27.56 | 10.03 | -26 |
| 594 | 5953 | δ Scorpii* | 2.32 | B0.2 Ive | 16 01 36.5 | 3.560 | -8 | -22 40 52.39 | -9.92 | -22 |
| 597 | 5984 | β Scorpii*pr | 2.62 | B0.5 V | 16 06 41.4 | 3.500 | -4 | -19 51 45.42 | 9.53 | -19 |
| 603 | 6056 | δ Ophiuchi | 2.74 | M0.5 III | 16 15 28.5 | 3.151 | -29 | -3 44 53.36 | 8.97 | -143 |
| 605 | 6075 | ε Ophiuchi | 3.24 | G9.5 IIIb | 16 19 27.7 | 3.181 | +57 | -4 44 36.10 | 8.47 | +41 |
| 608 | 6092 | τ Herculis | 3.89 | B5 IV | 16 20 23.3 | 1.808 | -11 | +46 15 47.07 | 8.40 | +40 |
| 607 | 6084 | σ Scorpii | 2.89 | B1 III | 16 22 29.9 | 3.659 | -8 | -25 38 33.58 | 8.29 | -21 |
| 609 | 6095 | γ Herculis | 3.75 | B9 III | 16 22 52.2 | 2.650 | -33 | +19 06 14.11 | -8.20 | +43 |
| 613 | 6117 | ω Herculis | 4.57 | B9 p | 16 26 24.6 | 2.773 | +30 | +13 59 06.50 | 8.02 | -59 |
| 616 | 6134 | α Scorpii* cg | 0.96 | M1.5 Iab-b | 16 30 43.7 | 3.690 | -7 | -26 28 40.37 | 7.63 | -20 |
| 618 | 6148 | β Herculis | 2.77 | G7 III a | 16 31 08.7 | 2.583 | -70 | +21 26 38.53 | 7.59 | -15 |
| 611 | 6102 | γ Apodis | 3.89 | G8III | 16 36 48.9 | 9.421 | -452 | -78 56 27.25 | 7.19 | -77 |
| 620 | 6165 | τ Scorpii | 2.82 | B0.2 V | 16 37 13.5 | 3.747 | -6 | -28 15 31.65 | 7.10 | -22 |
| 622 | 6175 | ζ Ophiuchi | 2.56 | O9V | 16 38 20.7 | 3.311 | +9 | -10 36 32.34 | -6.96 | +26 |
| 626 | 6220 | η Herculis | 3.53 | G7 .5IIIb | 16 43 38.1 | 2.060 | +32 | +38 52 56.93 | 6.64 | -82 |
| 625 | 6217 | α Tr. Austr.* | 1.92 | K2 II-III | 16 50 57.6 | 6.413 | +26 | -69 03 50.46 | 5.98 | -34 |
| 1438 | 6243 | 20 Ophiuchi | 4.65 | F7 V | 16 51 01.5 | 3.326 | +65 | -10 49 09.71 | 6.03 | -93 |
| 628 | 6241 | ε Scorpii | 2.29 | K1 III | 16 51 33.6 | 3.898 | -493 | -34 19 49.26 | 6.15 | -257 |
| 1435 | 6229 | η Arae | 3.76 | K5 III | 16 51 39.1 | 5.212 | +49 | -59 04 38.03 | 5.92 | -28 |
| 1439 | 6247 | μ' Scorpii | 3.08v | B1.5Vp+ | 16 53 19.9 | 4.077 | -9 | -38 04 56.17 | -5.77 | -25 |
| 633 | 6299 | κ Ophiuchi | 3.20 | K2 III | 16 58 41.2 | 2.844 | -197 | +9 20 35.03 | 5.31 | -11 |
| 631 | 6285 | ζ Arae | 3.13 | K3III | 17 00 24.4 | 4.989 | -23 | -56 01 17.70 | 5.19 | -36 |
| 634 | 6324 | ε Herculis | 3.92 | A0 V | 17 01 06.8 | 2.298 | -36 | +30 53 45.44 | 5.07 | +27 |
| 635 | 6355 | 60 Herculis | 4.91 | A4 IV | 17 06 22.6 | 2.786 | +35 | +12 42 46.00 | 4.66 | -10 |
| 639 | 6396 | ζ Draconis | 3.17 | B6 III | 17 08 51.2 | 0.188 | -33 | +65 41 17.83 | 4.41 | +22 |
| 638 | 6380 | η Scorpii | 3.33 | F5IV | 17 13 41.8 | 4.310 | +23 | -43 15 55.04 | -4.31 | -287 |
| 643 | 6418 | π Herculis | 3.16 | K3 Ib | 17 15 47.8 | 2.093 | -22 | +36 47 09.80 | 3.84 | +4 |
| 641 | 6410 | δ Herculis | 3.14 | A3IV | 17 15 55.0 | 2.467 | -15 | +24 48 54.60 | 3.99 | -157 |
| 644 | 6453 | θ Ophiuchi | 3.27 | B2 IV | 17 23 19.9 | 3.691 | -3 | -25 01 08.55 | 3.21 | -20 |
| 645 | 6461 | β Arae | 2.85 | K3 Ib-II | 17 27 05.5 | 5.002 | -9 | -55 32 51.48 | 2.89 | -25 |
| 1457 | 6486 | 44 Ophiuchi | 4.17 | kA5hA9mF1III | 17 27 41.1 | 3.670 | +0 | -24 11 35.41 | 2.93 | -116 |
| 653 | 6536 | β Draconis | 2.79 | G2Iab | 17 30 55.2 | 1.360 | -17 | +52 17 10.45 | -2.52 | +15 |
| 649 | 6508 | ν Scorpii | 2.69 | B2 IV | 17 32 13.7 | 4.086 | -1 | -37 18 39.15 | 2.45 | -31 |
| 648 | 6500 | δ Arae | 3.62 | B8 Vn | 17 33 02.6 | 5.432 | -79 | -60 41 56.14 | 2.45 | -96 |
| 651 | 6510 | α Arae | 2.95 | B2 Vne | 17 33 30.4 | 4.648 | -32 | -49 53 27.06 | 2.38 | -70 |
| 652 | 6527 | λ Scorpii* | 1.63 | B2 IV+ | 17 35 04.2 | 4.080 | -1 | -37 07 02.49 | 2.20 | -29 |
| 656 | 6556 | α Ophiuchi* | 2.08 | A5 III | 17 35 56.0 | 2.788 | +83 | +12 32 45.17 | -2.33 | -226 |

* **No. 594 : *Dschubba,* Anuradha**
**No. 597 : *Graffias,* Mag. 2.9, 5.1**
**No. 616 : *Antares*, Jyestha, Mag. 0.9 to 1.8.**
**No. 625 : *Atria.***
**No. 652 : *Schaula*, Mula.**
**No. 656 : *Ras Alhague.***

## MEAN PLACES OF STARS, J 2021.5

FOR JULY $2^{d}.375$ TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

| Cat. No. FK5 | BS =HR No. | Star | Mag. | Spec-tral Type | Right Ascension | Annual Variation | Annual Proper motion | Declination | Annual Variation | Annual Proper motion |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | h m s | s | s (0.0001) | ° ' " | " | " (0.001) |
| 658 | 6561 | ξ Serpentis | 3.54 | A9IIIpSr | 17 38 49.1 | 3.439 | -29 | -15 24 36.95 | -1.91 | -58 |
| 654 | 6553 | θ Scorpii | 1.87 | F1 II | 17 38 52.0 | 4.318 | +14 | -43 00 33.38 | 1.85 | -2 |
| 663 | 6588 | ι Herculis | 3.80 | B3 IV | 17 40 04.4 | 1.697 | -5 | +45 59 45.02 | 1.74 | +5 |
| 660 | 6580 | κ Scorpii | 2.41 | B1.5 III | 17 43 58.6 | 4.156 | -5 | -39 02 20.16 | 1.43 | -27 |
| 665 | 6603 | β Ophiuchi | 2.77 | K2 III | 17 44 32.1 | 2.966 | -27 | +4 33 35.64 | 1.19 | +159 |
| 667 | 6623 | μ Herculis | 3.42 | G5IV | 17 47 18.1 | 2.351 | -233 | +27 42 33.54 | 1.86 | -752 |
| 661 | 6582 | η Pavonis | 3.62 | K2II | 17 47 50.8 | 5.900 | -21 | -64 43 51.76 | -1.12 | -54 |
| 668 | 6629 | γ Ophiuchi | 3.75 | A0 V | 17 48 58.3 | 3.011 | -14 | +2 42 02.86 | 1.04 | -74 |
| 666 | 6615 | $\iota^{1}$ Scorpii | 3.03 | F2 I ae | 17 49 05.4 | 4.200 | -0 | -40 07 59.45 | 0.96 | -8 |
| 669 | 6630 | *G* Scorpii | 3.21 | K2 III | 17 51 19.4 | 4.087 | +41 | -37 02 52.83 | 0.73 | +33 |
| 671 | 6688 | ξ Draconis | 3.75 | K2 III | 17 53 54.1 | 1.040 | +114 | +56 52 11.46 | 0.45 | +80 |
| 672 | 6695 | θ Herculis | 3.86 | K1 IIaCn+ | 17 56 59.5 | 2.060 | +4 | +37 14 55.69 | 0.26 | +6 |
| 676 | 6705 | γ Draconis* | 2.23 | K5 III | 17 57 06.4 | 1.396 | -8 | +51 29 13.88 | -0.27 | -19 |
| 674 | 6703 | ξ Herculis | 3.70 | G8 III | 17 58 36.1 | 2.334 | +64 | +29 14 48.68 | 0.14 | -17 |
| 673 | 6698 | ν Ophiuchi | 3.34 | G 9 III | 18 00 12.7 | 3.305 | -4 | -9 46 28.31 | -0.10 | -116 |
| 677 | 6714 | 67 Ophiuchi | 3.97 | B5 Ib | 18 01 43.4 | 3.007 | +1 | +2 55 55.65 | +0.14 | -8 |
| 679 | 6746 | γ Sagittarii | 2.99 | K1III | 18 07 11.4 | 3.855 | -41 | -30 25 18.46 | 0.44 | -185 |
| 1471 | 6743 | θ Arae | 3.66 | B2 Ib | 18 08 18.3 | 4.671 | -10 | -50 05 15.83 | 0.71 | -14 |
| 680 | 6771 | 72 Ophiuchi | 3.73 | A4IVs | 18 08 22.2 | 2.846 | -41 | +9 34 06.36 | +0.81 | +80 |
| 681 | 6779 | *ο* Herculis | 3.83 | B9.5V | 18 08 22.9 | 2.342 | +1 | +28 46 00.18 | 0.74 | +10 |
| 682 | 6812 | μ Sagittarii | 3.86 | B2III | 18 15 03.0 | 3.589 | +1 | -21 03 04.69 | 1.32 | +1 |
| 683 | 6832 | η Sagittarii | 3.11 | M3.5 III | 18 19 04.9 | 4.059 | -106 | -36 45 11.27 | 1.50 | -167 |
| 695 | 6927 | χ Draconis | 3.57 | F7 V | 18 20 40.0 | -1.088 | +1200 | +72 44 30.02 | 1.46 | -346 |
| 687 | 6859 | δ Sagittarii* | 2.70 | K3IIIa | 18 22 22.2 | 3.840 | +27 | -29 49 01.23 | 1.93 | -28 |
| 688 | 6869 | η Serpentis | 3.26 | K0 III-IV | 18 22 25.4 | 3.106 | -364 | -2 53 29.76 | +1.26 | -701 |
| 690 | 6895 | 109 Herculis | 3.84 | K2 III | 18 24 36.9 | 2.559 | +141 | +21 46 51.21 | 1.91 | -242 |
| 689 | 6879 | ε Sagittarii* | 1.85 | B9.5III | 18 25 35.9 | 3.980 | -31 | -34 22 20.70 | 2.11 | -124 |
| 691 | 6897 | α Telescopii | 3.51 | B3 IV | 18 28 34.0 | 4.444 | -15 | -45 57 15.50 | 2.44 | -54 |
| 692 | 6913 | λ Sagittarii | 2.81 | K0IV | 18 29 17.8 | 3.702 | -32 | -25 24 28.44 | 2.37 | -185 |
| 697 | 6951 | θ Coronae Aust. | 4.64 | G8 III | 18 35 02.2 | 4.280 | +28 | -42 17 41.37 | 3.03 | -22 |
| 1482 | 6973 | α Scuti | 3.85 | K3 III | 18 36 22.6 | 3.265 | -10 | -8 13 38.32 | +2.86 | -312 |
| 699 | 7001 | α Lyrae* | 0.03 | A0 V | 18 37 40.0 | 2.033 | +172 | +38 48 17.15 | 3.57 | +287 |
| 1487 | 7039 | φ Sagittarii | 3.17 | B8 III | 18 46 59.9 | 3.745 | +40 | -26 58 00.30 | 4.08 | +1 |
| 1489 | 7063 | β Scuti | 4.22 | G4 IIa | 18 48 18.9 | 3.183 | -3 | -4 43 23.59 | 4.18 | -16 |
| 705 | 7106 | β Lyrae* | 3.45 | B7 Ve+ | 18 50 52.5 | 2.217 | +3 | +33 23 19.73 | 4.41 | -3 |
| 706 | 7121 | σ Sagittarii* | 2.02 | B2V | 18 56 35.8 | 3.716 | +10 | -26 16 05.27 | 4.84 | -54 |
| 710 | 7150 | $\xi^{2}$ Sagittarii | 3.51 | G9II/III | 18 59 00.7 | 3.576 | +24 | -21 04 35.65 | +5.09 | -12 |
| 713 | 7178 | γ Lyrae | 3.24 | B9 III | 18 59 44.9 | 2.246 | -2 | +32 43 12.81 | 5.17 | +2 |
| 712 | 7176 | ε Aquilae | 4.02 | K1 III | 19 00 35.9 | 2.724 | -35 | +15 05 55.95 | 5.16 | -74 |
| 716 | 7235 | ζ Aquilae | 2.99 | A0 Vn | 19 06 23.9 | 2.758 | -3 | +13 53 48.58 | 5.63 | -96 |
| 717 | 7236 | λ Aquilae | 3.44 | B9Vn | 19 07 23.4 | 3.183 | -11 | -4 50 55.21 | 5.72 | -90 |
| 1496 | 7234 | τ Sagittarii | 3.32 | K1III | 19 08 16.8 | 3.740 | -40 | -27 38 13.67 | +5.63 | -251 |

**No. 676 : *Eltanin.***
**No. 687 : Purvasadha-1.**
**No. 689 : *Kaus Australis*, Purvasadha-2.**
**No. 699 : *Vega*, Abhijit.**
**No. 705 : Sheliak Mag. 3.3 to 4.3.**
**No. 706 : *Nunki*, Uttarasadha.**

## MEAN PLACES OF STARS, J 2021.5

FOR JULY $2^d.375$ TERRESTRIAL TIME
(The Annual Variations are for the middle of the year)

| Cat. No. FK5 | BS =HR No. | Star | Mag. | Spectral Type | Right Ascension | Annual Variation | Annual Proper motion | Declination | Annual Variation | Annual Proper motion |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | h m s | s | s (0.0001) | ° ' " | " | " (0.001) |
| 720 | 7264 | π Sagittarii | 2.89 | F2 II/III | 19 11 02.5 | 3.563 | -0 | -20 59 15.52 | +6.08 | -35 |
| 723 | 7310 | δ Draconis | 3.07 | G9 III | 19 12 33.3 | -0.004 | +164 | +67 41 57.72 | 6.33 | +93 |
| 726 | 7328 | κ Cygni | 3.77 | G9 III | 19 17 35.9 | 1.384 | +66 | +53 24 31.91 | 6.78 | +125 |
| 730 | 7377 | δ Aquilae | 3.36 | F0IV | 19 26 34.9 | 3.024 | +171 | +3 09 32.94 | 7.48 | +83 |
| 1508 | 7405 | α Vulpeculae | 4.44 | M0III | 19 29 36.0 | 2.498 | -92 | +24 42 34.81 | 7.53 | -106 |
| 733 | 7420 | ι Cygni | 3.79 | A5V | 19 30 14.8 | 1.511 | +21 | +51 46 34.91 | 7.82 | +130 |
| 732 | 7417 | β Cygni*p | 3.08 | K3II+ | 19 31 35.3 | 2.421 | +2 | +28 00 21.70 | +7.80 | -2 |
| 1513 | 7488 | β Sagittae | 4.37 | G8III a | 19 42 00.9 | 2.695 | +7 | +17 31 37.78 | 8.60 | -32 |
| 741 | 7525 | γ Aquilae | 2.72 | K3 II | 19 47 16.9 | 2.852 | +12 | +10 40 01.30 | 9.04 | -2 |
| 743 | 7536 | δ Sagittae | 3.82 | M2 II+ | 19 48 20.8 | 2.676 | +5 | +18 35 18.92 | 9.13 | +8 |
| 745 | 7557 | α Aquilae* | 0.77 | A7 V | 19 51 49.9 | 2.926 | +362 | +8 55 35.49 | 9.78 | +387 |
| 746 | 7570 | η Aquilae | 3.90V. | F6Iab | 19 53 34.0 | 3.054 | +7 | +1 03 44.21 | 9.52 | -7 |
| 749 | 7602 | β Aquilae* | 3.71 | G9.5IV | 19 56 22.2 | 2.946 | +33 | +6 27 42.58 | +9.26 | -482 |
| 752 | 7635 | γ Sagittae | 3.47 | M0 III | 19 59 42.8 | 2.669 | +46 | +19 33 06.51 | 10.02 | +24 |
| 751 | 7623 | θ' Sagittarii | 4.37 | B3 IV | 20 01 07.9 | 3.890 | +5 | -35 12 59.14 | 10.08 | -26 |
| 754 | 7665 | δ Pavonis | 3.56 | G8 IV | 20 10 48.8 | 5.815 | +1997 | -66 07 28.55 | 9.70 | -1126 |
| 756 | 7710 | θ Aquilae | 3.23 | B9.5 III+ | 20 12 24.8 | 3.093 | +26 | +0 45 22.74 | 10.95 | +4 |
| 757 | 7735 | 31 $o^2$ Cygni | 3.79 | K2II+ | 20 14 18.5 | 1.890 | +4 | +46 48 26.71 | 11.09 | +3 |
| 761 | 7754 | $\alpha^2$ Capricorni* | 3.57 | G8.5III-IV | 20 19 14.7 | 3.322 | +44 | -12 28 36.27 | +11.44 | +4 |
| 762 | 7776 | β Capricorni | 3.08 | K0:II:+ | 20 22 13.0 | 3.364 | +29 | -14 42 43.32 | 11.66 | +2 |
| 765 | 7796 | γ Cygni | 2.20 | F8 I ab | 20 23 00.0 | 2.155 | +4 | +40 19 35.32 | 11.71 | 0 |
| 764 | 7790 | α Pavonis | 1.94 | B2IV | 20 27 20.1 | 4.702 | +9 | -56 39 51.24 | 11.93 | -89 |
| 768 | 7852 | ε Delphini | 4.03 | B6 III | 20 34 14.4 | 2.866 | +9 | +11 22 39.19 | 12.47 | -22 |
| (771) | 7882 | β Delphini*m | 3.64 | F5 IV | 20 38 33.4 | 2.814 | +81 | +14 40 15.45 | 12.74 | -48 |
| 769 | 7869 | α Indi | 3.11 | K0 III-IV | 20 39 04.2 | 4.190 | +52 | -47 12 53.45 | +12.89 | +66 |
| 774 | 7906 | α Delphini* | 3.77 | B9 IV | 20 40 38.2 | 2.787 | +46 | +15 59 20.42 | 12.92 | -2 |
| 777 | 7924 | α Cygni* | 1.25 | A2 Iae | 20 42 09.9 | 2.048 | +3 | +45 21 28.92 | 13.03 | +2 |
| 778 | 7928 | δ Delphini | 4.43 | A7IIIp | 20 44 27.8 | 2.801 | -13 | +15 09 10.13 | 13.14 | -43 |
| 783 | 7957 | η Cephei | 3.43 | K0 IV | 20 45 43.4 | 1.209 | +119 | +61 55 22.08 | 14.08 | +819 |
| 775 | 7913 | β Pavonis | 3.42 | A7III | 20 46 52.1 | 5.321 | -76 | -66 07 25.79 | 13.35 | +11 |
| 780 | 7949 | ε Cygni | 2.46 | K0 III | 20 47 04.9 | 2.431 | +286 | +34 03 06.41 | +13.68 | +329 |
| 1541 | 7948 | γ Delphini sq | 4.27 | K1 IV | 20 47 39.4 | 2.784 | -22 | +16 12 10.35 | 13.19 | -197 |
| 781 | 7950 | ε Aquarii | 3.77 | A1.5V | 20 48 50.3 | 3.242 | +24 | -9 24 56.79 | 13.43 | -34 |
| 1547 | 7990 | μ Aquarii | 4.73 | A3m | 20 53 48.7 | 3.230 | +30 | -8 54 05.01 | 13.75 | -30 |
| 785 | 7986 | β Indi | 3.65 | K1 II | 20 56 28.4 | 4.635 | +21 | -58 22 16.71 | 13.93 | -26 |
| 1550 | 8039 | γ Microscopii | 4.67 | G6III | 21 02 36.3 | 3.663 | -2 | -32 10 20.54 | 14.34 | +5 |
| 792 | 8079 | ξ Cygni | 3.72 | K4.5 Ib-II | 21 05 42.9 | 2.186 | +8 | +44 00 51.99 | +14.52 | +1 |
| 797 | 8115 | ζ Cygni | 3.20 | G8III | 21 13 51.2 | 2.557 | +1 | +30 18 57.84 | 14.95 | -56 |
| 800 | 8131 | α Equulei | 3.92 | G0III+ | 21 16 53.9 | 2.998 | +39 | +5 20 16.02 | 15.09 | -88 |
| 803 | 8162 | α Cephei* | 2.44 | A7IV | 21 19 05.5 | 1.427 | +219 | +62 40 37.83 | 15.35 | +50 |
| 806 | 8204 | ζ Capricorni | 3.74 | G4 Ibp | 21 27 53.5 | 3.413 | +1 | -22 19 01.59 | +15.81 | +23 |

* **No. 732 : *Albireo* ., Mag. *f*. 5.4.**
**No. 745 : *Altair* , Sravana.**
**No. 749 : *Alshain* .**
**No. 761 : Giedi or Algedi.**
**No. 771 : *Rotanev* , Dhanistha-1.**
**No. 774 : *Saulocin,* Dhanistha-2.**
**No. 777 : *Deneb.***
**No. 803 : *Alderamin.***

## MEAN PLACES OF STARS, J 2021.5

FOR JULY $2^d.375$ TERRESTRIAL TIME

(The Annual Variations are for the middle of the year)

| Cat. No. FK5 | BS =HR No. | Star | Mag. | Spectral Type | Right Ascension | Annual Variation | Annual Proper motion | Declination | Annual Variation | Annual Proper motion |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | h m s | s | s (0.0001) | ° ' " | " | " (0.001) |
| 809 | 8238 | β Cephei | 3.23 | B2 IIIev | 21 28 55.7 | 0.747 | +21 | +70 39 19.24 | +15.85 | +7 |
| 808 | 8232 | β Aquarii* | 2.91 | G0 Ib | 21 32 41.4 | 3.154 | +14 | -5 28 32.15 | 16.03 | -8 |
| 1569 | 8264 | ξ Aquarii | 4.69 | A7 V | 21 38 53.7 | 3.188 | +78 | -7 45 24.59 | 16.34 | -25 |
| 812 | 8278 | γ Capricorni | 3.68 | A7 mp | 21 41 16.8 | 3.315 | +132 | -16 33 51.19 | 16.46 | -23 |
| 810 | 8254 | ν Octantis | 3.76 | K1 III | 21 43 47.1 | 6.407 | +140 | -77 17 33.55 | 16.36 | -240 |
| 815 | 8308 | ε Pegasi* | 2.34 | K2 Ib | 21 45 14.5 | 2.947 | +21 | +9 58 27.89 | 16.67 | -1 |
| 819 | 8322 | δ Capricorni | 2.87 | kA5hF0mF2III | 21 48 13.5 | 3.302 | +183 | -16 01 43.63 | +16.52 | -296 |
| 822 | 8353 | γ Gruis | 3.01 | B8III | 21 55 13.4 | 3.610 | +86 | -37 15 46.08 | 17.12 | -21 |
| 827 | 8414 | α Aquarii* | 2.96 | G2 Ib | 22 06 53.2 | 3.079 | +13 | +0 12 52.69 | 17.64 | -10 |
| 831 | 8430 | ι Pegasi | 3.76 | F5 V | 22 08 00.8 | 2.799 | +220 | +25 27 02.89 | 17.72 | +25 |
| 829 | 8425 | α Gruis* | 1.74 | B6V | 22 09 34.7 | 3.749 | +126 | -46 51 21.57 | 17.61 | -151 |
| 834 | 8450 | θ Pegasi | 3.53 | A1Va | 22 11 17.1 | 3.026 | +185 | +6 18 15.71 | 17.86 | +27 |
| 836 | 8465 | ζ Cephei | 3.35 | K1.5 Iab | 22 11 36.2 | 2.092 | +19 | +58 18 27.87 | +17.85 | +4 |
| 841 | 8502 | α Tucanae | 2.86 | K3 III | 22 19 57.4 | 4.050 | -96 | -60 09 05.60 | 18.12 | -43 |
| 842 | 8518 | γ Aquarii | 3.84 | A0V | 22 22 46.0 | 3.096 | +88 | -1 16 42.02 | 18.27 | +7 |
| 846 | 8556 | δ' Gruis | 3.97 | G7III | 22 30 32.8 | 3.558 | +26 | -43 23 06.20 | 18.53 | -5 |
| 848 | 8585 | α Lacertae | 3.77 | A1 V | 22 32 10.9 | 2.486 | +144 | +50 23 36.80 | 18.61 | +19 |
| 849 | 8592 | v Aquarii | 5.20 | F7 V | 22 35 52.0 | 3.271 | +158 | -20 35 50.86 | 18.56 | -144 |
| 850 | 8597 | η Aquarii | 4.02 | B9 IV-V:n | 22 36 27.6 | 3.081 | +61 | +0 00 21.99 | +18.67 | -56 |
| 855 | 8634 | ζ Pegasi | 3.40 | B8V | 22 42 32.1 | 2.995 | +55 | +10 56 38.77 | 18.89 | -12 |
| 856 | 8636 | β Gruis | 2.10 | M5 III | 22 43 56.5 | 3.552 | +133 | -46 46 17.86 | 18.94 | -8 |
| 857 | 8650 | η Pegasi | 2.94 | G2II-III+ | 22 44 00.8 | 2.822 | +11 | +30 20 03.10 | 18.92 | -25 |
| 860 | 8675 | ε Gruis | 3.49 | A2IVnSB2 | 22 49 50.6 | 3.588 | +115 | -51 12 11.76 | 19.04 | -71 |
| 863 | 8694 | ι Cephei | 3.52 | K0III | 22 50 27.1 | 2.154 | -108 | +66 18 49.82 | 19.00 | -125 |
| 861 | 8679 | τ Aquarii | 4.01 | K5III | 22 50 43.7 | 3.170 | -8 | -13 28 43.20 | +19.10 | -38 |
| 862 | 8684 | μ Pegasi | 3.48 | G8 III | 22 51 02.6 | 2.904 | +108 | +24 42 56.06 | 19.10 | -42 |
| 864 | 8698 | λ Aquarii* | 3.74 | M2 III | 22 53 44.1 | 3.126 | +8 | -7 27 53.09 | 19.25 | +37 |
| 866 | 8709 | δ Aquarii | 3.27 | A3 V | 22 55 47.3 | 3.176 | -28 | -15 42 21.69 | 19.23 | -25 |
| 867 | 8728 | α PsA* | 1.16 | A4 V | 22 58 50.1 | 3.300 | +255 | -29 30 28.28 | 19.17 | -164 |
| 869 | 8762 | *o* Andromedae | 3.62 | B6III pe+ | 23 02 54.9 | 2.776 | +20 | +42 26 30.74 | 19.42 | -6 |
| 870 | 8775 | β Pegasi* | 2.42 | M2.5 II-III | 23 04 49.2 | 2.919 | +143 | +28 11 59.30 | +19.60 | +138 |
| 871 | 8781 | α Pegasi* | 2.49 | B9III | 23 05 50.0 | 2.994 | +44 | +15 19 16.68 | 19.44 | -42 |
| 873 | 8812 | 88 Aquarii | 3.66 | K1III | 23 10 35.4 | 3.189 | +40 | -21 03 19.26 | 19.61 | +31 |
| 878 | 8852 | γ Piscium | 3.69 | G9 III | 23 18 16.8 | 3.112 | +509 | +3 24 00.14 | 19.73 | +17 |
| 890 | 8961 | λ Andromedae | 3.82v | G8 III | 23 38 37.4 | 2.960 | +157 | +46 34 29.32 | 19.53 | -421 |
| 893 | 8974 | γ Cephei | 3.21 | K1 IV | 23 40 14.9 | 2.524 | -212 | +77 45 09.28 | 20.12 | +151 |
| 902 | 9072 | ω Piscium | 4.01 | F4V | 0 00 25.0 | 3.086 | +103 | +6 58 56.25 | +19.93 | -115 |

BS = Bright Star Catalogue HR = Havard Revised Catalogue FK5 = Fifth Fundamental Catalogue

* **No. 808 :** ***Sadalsuud.***
**No. 815 :** ***Enif*. Mag. 0.7 to 3.5.**
**No. 827 :** ***Sadalmelik.***
**No. 829 :** ***Al Nair.***
**No. 864 : Satabhisaj.**
**No. 867 :** ***Fomalhaut*.**
**No. 870 :** ***Scheat*, Purva Bhadrapada-2.**
**No. 871 :** ***Markab*, Purva Bhadrapada-1.**

## APPARENT PLACES OF STARS, 2021

FOR $0^h$ TERRESTRIAL TIME

| Name | | γ Pegasi | | | | | | α Phoenicis | | | | | | β Ceti | | | | | | β Andromedae | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mag. Spect. | | 2.83 | | | B2 IV | | | 2.39 | | | K0 III | | | 2.04 | | | K0 III | | | 2.06 | | | M0 III | | |
| U.T. | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | |
| | | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " |
| Jan. | 1 | 0 | 14 | 18 | +15 | 17 | 58 | 0 | 27 | 18 | -42 | 11 | 53 | 0 | 44 | 38 | -17 | 52 | 32 | 1 | 10 | 54 | +35 | 43 | 58 |
| | 11 | 0 | 14 | 18 | 15 | 17 | 58 | 0 | 27 | 18 | 42 | 11 | 53 | 0 | 44 | 38 | 17 | 52 | 33 | 1 | 10 | 54 | 35 | 43 | 57 |
| | 21 | 0 | 14 | 18 | 15 | 17 | 57 | 0 | 27 | 18 | 42 | 11 | 53 | 0 | 44 | 37 | 17 | 52 | 33 | 1 | 10 | 54 | 35 | 43 | 57 |
| | 31 | 0 | 14 | 18 | 15 | 17 | 56 | 0 | 27 | 18 | 42 | 11 | 52 | 0 | 44 | 37 | 17 | 52 | 33 | 1 | 10 | 53 | 35 | 43 | 56 |
| Feb. | 10 | 0 | 14 | 18 | 15 | 17 | 55 | 0 | 27 | 17 | 42 | 11 | 50 | 0 | 44 | 37 | 17 | 52 | 32 | 1 | 10 | 53 | 35 | 43 | 55 |
| | 20 | 0 | 14 | 18 | 15 | 17 | 54 | 0 | 27 | 17 | 42 | 11 | 48 | 0 | 44 | 37 | 17 | 52 | 32 | 1 | 10 | 53 | 35 | 43 | 53 |
| Mar. | 2 | 0 | 14 | 17 | +15 | 17 | 53 | 0 | 27 | 17 | -42 | 11 | 46 | 0 | 44 | 37 | -17 | 52 | 31 | 1 | 10 | 53 | +35 | 43 | 52 |
| | 12 | 0 | 14 | 17 | 15 | 17 | 52 | 0 | 27 | 17 | 42 | 11 | 44 | 0 | 44 | 37 | 17 | 52 | 30 | 1 | 10 | 53 | 35 | 43 | 50 |
| | 22 | 0 | 14 | 18 | 15 | 17 | 51 | 0 | 27 | 17 | 42 | 11 | 41 | 0 | 44 | 37 | 17 | 52 | 28 | 1 | 10 | 53 | 35 | 43 | 48 |
| Apr. | 1 | 0 | 14 | 18 | 15 | 17 | 51 | 0 | 27 | 17 | 42 | 11 | 38 | 0 | 44 | 37 | 17 | 52 | 27 | 1 | 10 | 53 | 35 | 43 | 47 |
| | 11 | 0 | 14 | 18 | 15 | 17 | 51 | 0 | 27 | 17 | 42 | 11 | 35 | 0 | 44 | 37 | 17 | 52 | 25 | 1 | 10 | 53 | 35 | 43 | 46 |
| | 21 | 0 | 14 | 18 | 15 | 17 | 51 | 0 | 27 | 18 | 42 | 11 | 32 | 0 | 44 | 37 | 17 | 52 | 23 | 1 | 10 | 53 | 35 | 43 | 44 |
| May | 1 | 0 | 14 | 18 | +15 | 17 | 52 | 0 | 27 | 18 | -42 | 11 | 29 | 0 | 44 | 37 | -17 | 52 | 21 | 1 | 10 | 53 | +35 | 43 | 44 |
| | 11 | 0 | 14 | 18 | 15 | 17 | 52 | 0 | 27 | 18 | 42 | 11 | 26 | 0 | 44 | 38 | 17 | 52 | 18 | 1 | 10 | 53 | 35 | 43 | 43 |
| | 21 | 0 | 14 | 19 | 15 | 17 | 54 | 0 | 27 | 18 | 42 | 11 | 23 | 0 | 44 | 38 | 17 | 52 | 16 | 1 | 10 | 54 | 35 | 43 | 43 |
| | 31 | 0 | 14 | 19 | 15 | 17 | 55 | 0 | 27 | 19 | 42 | 11 | 20 | 0 | 44 | 38 | 17 | 52 | 13 | 1 | 10 | 54 | 35 | 43 | 44 |
| June | 10 | 0 | 14 | 19 | 15 | 17 | 57 | 0 | 27 | 19 | 42 | 11 | 18 | 0 | 44 | 38 | 17 | 52 | 11 | 1 | 10 | 54 | 35 | 43 | 44 |
| | 20 | 0 | 14 | 19 | 15 | 17 | 58 | 0 | 27 | 19 | 42 | 11 | 16 | 0 | 44 | 39 | 17 | 52 | 09 | 1 | 10 | 55 | 35 | 43 | 45 |
| | 30 | 0 | 14 | 20 | +15 | 18 | 01 | 0 | 27 | 20 | -42 | 11 | 14 | 0 | 44 | 39 | -17 | 52 | 06 | 1 | 10 | 55 | +35 | 43 | 47 |
| July | 10 | 0 | 14 | 20 | 15 | 18 | 03 | 0 | 27 | 20 | 42 | 11 | 12 | 0 | 44 | 39 | 17 | 52 | 05 | 1 | 10 | 55 | 35 | 43 | 48 |
| | 20 | 0 | 14 | 20 | 15 | 18 | 05 | 0 | 27 | 21 | 42 | 11 | 11 | 0 | 44 | 40 | 17 | 52 | 03 | 1 | 10 | 56 | 35 | 43 | 50 |
| | 30 | 0 | 14 | 21 | 15 | 18 | 07 | 0 | 27 | 21 | 42 | 11 | 11 | 0 | 44 | 40 | 17 | 52 | 02 | 1 | 10 | 56 | 35 | 43 | 52 |
| Aug. | 9 | 0 | 14 | 21 | 15 | 18 | 09 | 0 | 27 | 21 | 42 | 11 | 11 | 0 | 44 | 40 | 17 | 52 | 00 | 1 | 10 | 57 | 35 | 43 | 55 |
| | 19 | 0 | 14 | 21 | 15 | 18 | 11 | 0 | 27 | 22 | 42 | 11 | 11 | 0 | 44 | 41 | 17 | 51 | 60 | 1 | 10 | 57 | 35 | 43 | 57 |
| | 29 | 0 | 14 | 21 | +15 | 18 | 13 | 0 | 27 | 22 | -42 | 11 | 12 | 0 | 44 | 41 | -17 | 51 | 60 | 1 | 10 | 57 | +35 | 43 | 59 |
| Sept. | 8 | 0 | 14 | 22 | 15 | 18 | 15 | 0 | 27 | 22 | 42 | 11 | 14 | 0 | 44 | 41 | 17 | 51 | 60 | 1 | 10 | 57 | 35 | 44 | 02 |
| | 18 | 0 | 14 | 22 | 15 | 18 | 17 | 0 | 27 | 22 | 42 | 11 | 15 | 0 | 44 | 41 | 17 | 51 | 60 | 1 | 10 | 58 | 35 | 44 | 05 |
| | 28 | 0 | 14 | 22 | 15 | 18 | 18 | 0 | 27 | 22 | 42 | 11 | 17 | 0 | 44 | 41 | 17 | 52 | 01 | 1 | 10 | 58 | 35 | 44 | 07 |
| Oct. | 8 | 0 | 14 | 22 | 15 | 18 | 19 | 0 | 27 | 22 | 42 | 11 | 19 | 0 | 44 | 41 | 17 | 52 | 02 | 1 | 10 | 58 | 35 | 44 | 09 |
| | 18 | 0 | 14 | 22 | 15 | 18 | 20 | 0 | 27 | 22 | 42 | 11 | 21 | 0 | 44 | 41 | 17 | 52 | 03 | 1 | 10 | 58 | 35 | 44 | 11 |
| | 28 | 0 | 14 | 22 | +15 | 18 | 20 | 0 | 27 | 22 | -42 | 11 | 24 | 0 | 44 | 41 | -17 | 52 | 04 | 1 | 10 | 58 | +35 | 44 | 13 |
| Nov. | 7 | 0 | 14 | 22 | 15 | 18 | 21 | 0 | 27 | 22 | 42 | 11 | 26 | 0 | 44 | 41 | 17 | 52 | 05 | 1 | 10 | 58 | 35 | 44 | 14 |
| | 17 | 0 | 14 | 22 | 15 | 18 | 21 | 0 | 27 | 22 | 42 | 11 | 28 | 0 | 44 | 41 | 17 | 52 | 06 | 1 | 10 | 58 | 35 | 44 | 16 |
| | 27 | 0 | 14 | 22 | 15 | 18 | 21 | 0 | 27 | 22 | 42 | 11 | 30 | 0 | 44 | 41 | 17 | 52 | 08 | 1 | 10 | 58 | 35 | 44 | 17 |
| Dec. | 7 | 0 | 14 | 21 | 15 | 18 | 21 | 0 | 27 | 22 | 42 | 11 | 31 | 0 | 44 | 41 | 17 | 52 | 09 | 1 | 10 | 58 | 35 | 44 | 18 |
| | 17 | 0 | 14 | 21 | 15 | 18 | 20 | 0 | 27 | 22 | 42 | 11 | 32 | 0 | 44 | 41 | 17 | 52 | 10 | 1 | 10 | 58 | 35 | 44 | 18 |
| | 27 | 0 | 14 | 21 | +15 | 18 | 20 | 0 | 27 | 21 | -42 | 11 | 32 | 0 | 44 | 41 | -17 | 52 | 11 | 1 | 10 | 57 | +35 | 44 | 19 |
| | 37 | 0 | 14 | 21 | +15 | 18 | 19 | 0 | 27 | 21 | -42 | 11 | 32 | 0 | 44 | 41 | -17 | 52 | 11 | 1 | 10 | 57 | +35 | 44 | 19 |

## APPARENT PLACES OF STARS, 2021

FOR $0^h$ TERRESTRIAL TIME

| Name | | ζ Ceti | | | | | | ν Ceti | | | | | | α Arietis | | | | | | α Ceti | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mag. Spect. | | 3.73 | | | K0 III | | | 4.00 | | | F7III | | | 2.00 | | | K2 III | | | 2.53 | | | M1.5IIIa | | |
| U.T. | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | |
| | | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " |
| Jan. | 1 | 1 | 52 | 29 | -10 | 14 | 06 | 2 | 00 | 59 | -20 | 58 | 50 | 2 | 08 | 21 | +23 | 33 | 40 | 3 | 03 | 23 | +4 | 10 | 11 |
| | 11 | 1 | 52 | 29 | 10 | 14 | 06 | 2 | 00 | 59 | 20 | 58 | 51 | 2 | 08 | 21 | 23 | 33 | 40 | 3 | 03 | 22 | 4 | 10 | 11 |
| | 21 | 1 | 52 | 29 | 10 | 14 | 07 | 2 | 00 | 59 | 20 | 58 | 52 | 2 | 08 | 21 | 23 | 33 | 40 | 3 | 03 | 22 | 4 | 10 | 10 |
| | 31 | 1 | 52 | 29 | 10 | 14 | 07 | 2 | 00 | 59 | 20 | 58 | 52 | 2 | 08 | 21 | 23 | 33 | 39 | 3 | 03 | 22 | 4 | 10 | 10 |
| Feb. | 10 | 1 | 52 | 29 | 10 | 14 | 07 | 2 | 00 | 59 | 20 | 58 | 52 | 2 | 08 | 21 | 23 | 33 | 38 | 3 | 03 | 22 | 4 | 10 | 09 |
| | 20 | 1 | 52 | 29 | 10 | 14 | 07 | 2 | 00 | 59 | 20 | 58 | 51 | 2 | 08 | 20 | 23 | 33 | 38 | 3 | 03 | 22 | 4 | 10 | 09 |
| Mar. | 2 | 1 | 52 | 29 | -10 | 14 | 07 | 2 | 00 | 58 | -20 | 58 | 50 | 2 | 08 | 20 | +23 | 33 | 37 | 3 | 03 | 22 | +4 | 10 | 09 |
| | 12 | 1 | 52 | 29 | 10 | 14 | 06 | 2 | 00 | 58 | 20 | 58 | 49 | 2 | 08 | 20 | 23 | 33 | 36 | 3 | 03 | 22 | 4 | 10 | 09 |
| | 22 | 1 | 52 | 28 | 10 | 14 | 05 | 2 | 00 | 58 | 20 | 58 | 48 | 2 | 08 | 20 | 23 | 33 | 35 | 3 | 03 | 22 | 4 | 10 | 09 |
| Apr. | 1 | 1 | 52 | 28 | 10 | 14 | 04 | 2 | 00 | 58 | 20 | 58 | 46 | 2 | 08 | 20 | 23 | 33 | 34 | 3 | 03 | 21 | 4 | 10 | 09 |
| | 11 | 1 | 52 | 28 | 10 | 14 | 03 | 2 | 00 | 58 | 20 | 58 | 44 | 2 | 08 | 20 | 23 | 33 | 34 | 3 | 03 | 21 | 4 | 10 | 10 |
| | 21 | 1 | 52 | 28 | 10 | 14 | 01 | 2 | 00 | 58 | 20 | 58 | 42 | 2 | 08 | 20 | 23 | 33 | 33 | 3 | 03 | 21 | 4 | 10 | 10 |
| May | 1 | 1 | 52 | 29 | -10 | 14 | 00 | 2 | 00 | 58 | -20 | 58 | 40 | 2 | 08 | 20 | +23 | 33 | 33 | 3 | 03 | 21 | +4 | 10 | 11 |
| | 11 | 1 | 52 | 29 | 10 | 13 | 58 | 2 | 00 | 58 | 20 | 58 | 37 | 2 | 08 | 20 | 23 | 33 | 33 | 3 | 03 | 21 | 4 | 10 | 12 |
| | 21 | 1 | 52 | 29 | 10 | 13 | 55 | 2 | 00 | 59 | 20 | 58 | 35 | 2 | 08 | 21 | 23 | 33 | 33 | 3 | 03 | 22 | 4 | 10 | 13 |
| | 31 | 1 | 52 | 29 | 10 | 13 | 53 | 2 | 00 | 59 | 20 | 58 | 32 | 2 | 08 | 21 | 23 | 33 | 34 | 3 | 03 | 22 | 4 | 10 | 15 |
| June | 10 | 1 | 52 | 29 | 10 | 13 | 51 | 2 | 00 | 59 | 20 | 58 | 30 | 2 | 08 | 21 | 23 | 33 | 35 | 3 | 03 | 22 | 4 | 10 | 16 |
| | 20 | 1 | 52 | 30 | 10 | 13 | 49 | 2 | 00 | 59 | 20 | 58 | 27 | 2 | 08 | 21 | 23 | 33 | 36 | 3 | 03 | 22 | 4 | 10 | 18 |
| | 30 | 1 | 52 | 30 | -10 | 13 | 46 | 2 | 01 | 00 | -20 | 58 | 24 | 2 | 08 | 22 | +23 | 33 | 37 | 3 | 03 | 23 | +4 | 10 | 20 |
| July | 10 | 1 | 52 | 30 | 10 | 13 | 44 | 2 | 01 | 00 | 20 | 58 | 22 | 2 | 08 | 22 | 23 | 33 | 39 | 3 | 03 | 23 | 4 | 10 | 22 |
| | 20 | 1 | 52 | 31 | 10 | 13 | 42 | 2 | 01 | 00 | 20 | 58 | 20 | 2 | 08 | 22 | 23 | 33 | 40 | 3 | 03 | 23 | 4 | 10 | 23 |
| | 30 | 1 | 52 | 31 | 10 | 13 | 40 | 2 | 01 | 01 | 20 | 58 | 19 | 2 | 08 | 23 | 23 | 33 | 42 | 3 | 03 | 23 | 4 | 10 | 25 |
| Aug. | 9 | 1 | 52 | 31 | 10 | 13 | 39 | 2 | 01 | 01 | 20 | 58 | 17 | 2 | 08 | 23 | 23 | 33 | 44 | 3 | 03 | 24 | 4 | 10 | 27 |
| | 19 | 1 | 52 | 32 | 10 | 13 | 38 | 2 | 01 | 01 | 20 | 58 | 16 | 2 | 08 | 23 | 23 | 33 | 46 | 3 | 03 | 24 | 4 | 10 | 28 |
| | 29 | 1 | 52 | 32 | -10 | 13 | 37 | 2 | 01 | 02 | -20 | 58 | 16 | 2 | 08 | 24 | +23 | 33 | 47 | 3 | 03 | 24 | +4 | 10 | 29 |
| Sept. | 8 | 1 | 52 | 32 | 10 | 13 | 36 | 2 | 01 | 02 | 20 | 58 | 16 | 2 | 08 | 24 | 23 | 33 | 49 | 3 | 03 | 25 | 4 | 10 | 30 |
| | 18 | 1 | 52 | 32 | 10 | 13 | 36 | 2 | 01 | 02 | 20 | 58 | 16 | 2 | 08 | 24 | 23 | 33 | 51 | 3 | 03 | 25 | 4 | 10 | 31 |
| | 28 | 1 | 52 | 32 | 10 | 13 | 37 | 2 | 01 | 02 | 20 | 58 | 17 | 2 | 08 | 24 | 23 | 33 | 52 | 3 | 03 | 25 | 4 | 10 | 32 |
| Oct. | 8 | 1 | 52 | 32 | 10 | 13 | 37 | 2 | 01 | 02 | 20 | 58 | 18 | 2 | 08 | 24 | 23 | 33 | 54 | 3 | 03 | 25 | 4 | 10 | 32 |
| | 18 | 1 | 52 | 33 | 10 | 13 | 38 | 2 | 01 | 02 | 20 | 58 | 19 | 2 | 08 | 25 | 23 | 33 | 55 | 3 | 03 | 25 | 4 | 10 | 32 |
| | 28 | 1 | 52 | 33 | -10 | 13 | 39 | 2 | 01 | 03 | -20 | 58 | 21 | 2 | 08 | 25 | +23 | 33 | 56 | 3 | 03 | 26 | +4 | 10 | 32 |
| Nov. | 7 | 1 | 52 | 33 | 10 | 13 | 40 | 2 | 01 | 03 | 20 | 58 | 22 | 2 | 08 | 25 | 23 | 33 | 57 | 3 | 03 | 26 | 4 | 10 | 31 |
| | 17 | 1 | 52 | 33 | 10 | 13 | 41 | 2 | 01 | 03 | 20 | 58 | 24 | 2 | 08 | 25 | 23 | 33 | 58 | 3 | 03 | 26 | 4 | 10 | 31 |
| | 27 | 1 | 52 | 33 | 10 | 13 | 42 | 2 | 01 | 03 | 20 | 58 | 26 | 2 | 08 | 25 | 23 | 33 | 59 | 3 | 03 | 26 | 4 | 10 | 30 |
| Dec. | 7 | 1 | 52 | 33 | 10 | 13 | 43 | 2 | 01 | 03 | 20 | 58 | 27 | 2 | 08 | 25 | 23 | 33 | 59 | 3 | 03 | 26 | 4 | 10 | 30 |
| | 17 | 1 | 52 | 33 | 10 | 13 | 44 | 2 | 01 | 02 | 20 | 58 | 29 | 2 | 08 | 25 | 23 | 33 | 59 | 3 | 03 | 26 | 4 | 10 | 29 |
| | 27 | 1 | 52 | 33 | -10 | 13 | 45 | 2 | 01 | 02 | -20 | 58 | 30 | 2 | 08 | 25 | +23 | 33 | 59 | 3 | 03 | 26 | +4 | 10 | 28 |
| | 37 | 1 | 52 | 32 | -10 | 13 | 46 | 2 | 01 | 02 | -20 | 58 | 31 | 2 | 08 | 25 | +23 | 33 | 59 | 3 | 03 | 26 | +4 | 10 | 28 |

## APPARENT PLACES OF STARS, 2021

FOR $0^h$ TERRESTRIAL TIME

| Name | | η Tauri | | | | | | α Tauri | | | | | | β Eridani | | | | | | γ Orionis | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mag. Spect. | | 2.87 | | | B7 III | | | 0.85 | | | K5 III | | | 2.79 | | | K4 III | | | 1.64 | | | B2 III | | |
| U.T. | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | |
| | | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " |
| Jan. | 1 | 3 | 48 | 44 | +24 | 10 | 09 | 4 | 37 | 08 | +16 | 33 | 00 | 5 | 08 | 53 | -5 | 03 | 41 | 5 | 26 | 16 | +6 | 22 | 01 |
| | 11 | 3 | 48 | 44 | 24 | 10 | 09 | 4 | 37 | 08 | 16 | 33 | 00 | 5 | 08 | 53 | 5 | 03 | 43 | 5 | 26 | 16 | 6 | 22 | 00 |
| | 21 | 3 | 48 | 44 | 24 | 10 | 09 | 4 | 37 | 08 | 16 | 33 | 00 | 5 | 08 | 53 | 5 | 03 | 44 | 5 | 26 | 16 | 6 | 22 | 00 |
| | 31 | 3 | 48 | 44 | 24 | 10 | 09 | 4 | 37 | 08 | 16 | 33 | 00 | 5 | 08 | 53 | 5 | 03 | 44 | 5 | 26 | 16 | 6 | 21 | 59 |
| Feb. | 10 | 3 | 48 | 44 | 24 | 10 | 09 | 4 | 37 | 08 | 16 | 32 | 59 | 5 | 08 | 53 | 5 | 03 | 45 | 5 | 26 | 16 | 6 | 21 | 59 |
| | 20 | 3 | 48 | 44 | 24 | 10 | 08 | 4 | 37 | 07 | 16 | 32 | 59 | 5 | 08 | 53 | 5 | 03 | 46 | 5 | 26 | 15 | 6 | 21 | 58 |
| Mar. | 2 | 3 | 48 | 43 | +24 | 10 | 08 | 4 | 37 | 07 | +16 | 32 | 59 | 5 | 08 | 53 | -5 | 03 | 46 | 5 | 26 | 15 | +6 | 21 | 58 |
| | 12 | 3 | 48 | 43 | 24 | 10 | 08 | 4 | 37 | 07 | 16 | 32 | 59 | 5 | 08 | 53 | 5 | 03 | 46 | 5 | 26 | 15 | 6 | 21 | 58 |
| | 22 | 3 | 48 | 43 | 24 | 10 | 07 | 4 | 37 | 07 | 16 | 32 | 59 | 5 | 08 | 52 | 5 | 03 | 46 | 5 | 26 | 15 | 6 | 21 | 58 |
| Apr. | 1 | 3 | 48 | 43 | 24 | 10 | 06 | 4 | 37 | 07 | 16 | 32 | 58 | 5 | 08 | 52 | 5 | 03 | 46 | 5 | 26 | 15 | 6 | 21 | 58 |
| | 11 | 3 | 48 | 43 | 24 | 10 | 06 | 4 | 37 | 07 | 16 | 32 | 59 | 5 | 08 | 52 | 5 | 03 | 45 | 5 | 26 | 15 | 6 | 21 | 59 |
| | 21 | 3 | 48 | 43 | 24 | 10 | 06 | 4 | 37 | 06 | 16 | 32 | 58 | 5 | 08 | 52 | 5 | 03 | 44 | 5 | 26 | 15 | 6 | 21 | 59 |
| May | 1 | 3 | 48 | 43 | +24 | 10 | 05 | 4 | 37 | 06 | +16 | 32 | 58 | 5 | 08 | 52 | -5 | 03 | 43 | 5 | 26 | 14 | +6 | 21 | 59 |
| | 11 | 3 | 48 | 43 | 24 | 10 | 05 | 4 | 37 | 06 | 16 | 32 | 59 | 5 | 08 | 52 | 5 | 03 | 42 | 5 | 26 | 14 | 6 | 22 | 00 |
| | 21 | 3 | 48 | 43 | 24 | 10 | 05 | 4 | 37 | 06 | 16 | 32 | 59 | 5 | 08 | 52 | 5 | 03 | 40 | 5 | 26 | 14 | 6 | 22 | 01 |
| | 31 | 3 | 48 | 43 | 24 | 10 | 05 | 4 | 37 | 07 | 16 | 32 | 59 | 5 | 08 | 52 | 5 | 03 | 39 | 5 | 26 | 14 | 6 | 22 | 02 |
| June | 10 | 3 | 48 | 43 | 24 | 10 | 05 | 4 | 37 | 07 | 16 | 33 | 00 | 5 | 08 | 52 | 5 | 03 | 37 | 5 | 26 | 15 | 6 | 22 | 03 |
| | 20 | 3 | 48 | 43 | 24 | 10 | 06 | 4 | 37 | 07 | 16 | 33 | 01 | 5 | 08 | 52 | 5 | 03 | 35 | 5 | 26 | 15 | 6 | 22 | 04 |
| | 30 | 3 | 48 | 44 | +24 | 10 | 07 | 4 | 37 | 07 | +16 | 33 | 02 | 5 | 08 | 52 | -5 | 03 | 33 | 5 | 26 | 15 | +6 | 22 | 05 |
| July | 10 | 3 | 48 | 44 | 24 | 10 | 07 | 4 | 37 | 07 | 16 | 33 | 02 | 5 | 08 | 53 | 5 | 03 | 32 | 5 | 26 | 15 | 6 | 22 | 06 |
| | 20 | 3 | 48 | 44 | 24 | 10 | 08 | 4 | 37 | 08 | 16 | 33 | 03 | 5 | 08 | 53 | 5 | 03 | 30 | 5 | 26 | 15 | 6 | 22 | 08 |
| | 30 | 3 | 48 | 45 | 24 | 10 | 10 | 4 | 37 | 08 | 16 | 33 | 05 | 5 | 08 | 53 | 5 | 03 | 28 | 5 | 26 | 15 | 6 | 22 | 09 |
| Aug. | 9 | 3 | 48 | 45 | 24 | 10 | 11 | 4 | 37 | 08 | 16 | 33 | 06 | 5 | 08 | 53 | 5 | 03 | 27 | 5 | 26 | 16 | 6 | 22 | 10 |
| | 19 | 3 | 48 | 45 | 24 | 10 | 12 | 4 | 37 | 09 | 16 | 33 | 07 | 5 | 08 | 54 | 5 | 03 | 25 | 5 | 26 | 16 | 6 | 22 | 11 |
| | 29 | 3 | 48 | 46 | +24 | 10 | 13 | 4 | 37 | 09 | +16 | 33 | 07 | 5 | 08 | 54 | -5 | 03 | 24 | 5 | 26 | 16 | +6 | 22 | 12 |
| Sept. | 8 | 3 | 48 | 46 | 24 | 10 | 14 | 4 | 37 | 09 | 16 | 33 | 08 | 5 | 08 | 54 | 5 | 03 | 23 | 5 | 26 | 17 | 6 | 22 | 13 |
| | 18 | 3 | 48 | 46 | 24 | 10 | 16 | 4 | 37 | 09 | 16 | 33 | 09 | 5 | 08 | 54 | 5 | 03 | 23 | 5 | 26 | 17 | 6 | 22 | 13 |
| | 28 | 3 | 48 | 47 | 24 | 10 | 16 | 4 | 37 | 10 | 16 | 33 | 09 | 5 | 08 | 55 | 5 | 03 | 23 | 5 | 26 | 17 | 6 | 22 | 13 |
| Oct. | 8 | 3 | 48 | 47 | 24 | 10 | 17 | 4 | 37 | 10 | 16 | 33 | 10 | 5 | 08 | 55 | 5 | 03 | 23 | 5 | 26 | 17 | 6 | 22 | 13 |
| | 18 | 3 | 48 | 47 | 24 | 10 | 18 | 4 | 37 | 10 | 16 | 33 | 10 | 5 | 08 | 55 | 5 | 03 | 24 | 5 | 26 | 18 | 6 | 22 | 13 |
| | 28 | 3 | 48 | 47 | +24 | 10 | 19 | 4 | 37 | 11 | +16 | 33 | 10 | 5 | 08 | 55 | -5 | 03 | 25 | 5 | 26 | 18 | +6 | 22 | 12 |
| Nov. | 7 | 3 | 48 | 47 | 24 | 10 | 20 | 4 | 37 | 11 | 16 | 33 | 10 | 5 | 08 | 56 | 5 | 03 | 26 | 5 | 26 | 18 | 6 | 22 | 12 |
| | 17 | 3 | 48 | 48 | 24 | 10 | 20 | 4 | 37 | 11 | 16 | 33 | 10 | 5 | 08 | 56 | 5 | 03 | 27 | 5 | 26 | 19 | 6 | 22 | 11 |
| | 27 | 3 | 48 | 48 | 24 | 10 | 21 | 4 | 37 | 11 | 16 | 33 | 10 | 5 | 08 | 56 | 5 | 03 | 29 | 5 | 26 | 19 | 6 | 22 | 10 |
| Dec. | 7 | 3 | 48 | 48 | 24 | 10 | 21 | 4 | 37 | 11 | 16 | 33 | 10 | 5 | 08 | 56 | 5 | 03 | 30 | 5 | 26 | 19 | 6 | 22 | 09 |
| | 17 | 3 | 48 | 48 | 24 | 10 | 22 | 4 | 37 | 11 | 16 | 33 | 10 | 5 | 08 | 56 | 5 | 03 | 32 | 5 | 26 | 19 | 6 | 22 | 08 |
| | 27 | 3 | 48 | 48 | +24 | 10 | 22 | 4 | 37 | 11 | +16 | 33 | 10 | 5 | 08 | 56 | -5 | 03 | 33 | 5 | 26 | 19 | +6 | 22 | 07 |
| | 37 | 3 | 48 | 48 | +24 | 10 | 22 | 4 | 37 | 11 | +16 | 33 | 10 | 5 | 08 | 56 | -5 | 03 | 34 | 5 | 26 | 19 | +6 | 22 | 06 |

## APPARENT PLACES OF STARS, 2021

FOR $0^h$ TERRESTRIAL TIME

| Name | | β Leporis | | | | | | ι Orionis | | | | | | α Columbae | | | | | | κ Orionis | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mag. Spect. | | 2.84 | | | G5 II | | | 2.77 | | | O9 III | | | 2.64 | | | B5 Ive | | | 2.06 | | | B0Iab | | |
| U.T. | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | |
| | | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " |
| Jan. | 1 | 5 | 29 | 09 | -20 | 44 | 42 | 5 | 36 | 28 | -5 | 53 | 53 | 5 | 40 | 26 | -34 | 03 | 54 | 5 | 48 | 46 | -9 | 39 | 50 |
| | 11 | 5 | 29 | 09 | 20 | 44 | 44 | 5 | 36 | 28 | 5 | 53 | 55 | 5 | 40 | 26 | 34 | 03 | 57 | 5 | 48 | 46 | 9 | 39 | 52 |
| | 21 | 5 | 29 | 09 | 20 | 44 | 46 | 5 | 36 | 28 | 5 | 53 | 56 | 5 | 40 | 25 | 34 | 03 | 59 | 5 | 48 | 46 | 9 | 39 | 53 |
| | 31 | 5 | 29 | 09 | 20 | 44 | 47 | 5 | 36 | 28 | 5 | 53 | 57 | 5 | 40 | 25 | 34 | 04 | 01 | 5 | 48 | 46 | 9 | 39 | 55 |
| Feb. | 10 | 5 | 29 | 09 | 20 | 44 | 49 | 5 | 36 | 28 | 5 | 53 | 58 | 5 | 40 | 25 | 34 | 04 | 03 | 5 | 48 | 45 | 9 | 39 | 56 |
| | 20 | 5 | 29 | 09 | 20 | 44 | 50 | 5 | 36 | 28 | 5 | 53 | 58 | 5 | 40 | 25 | 34 | 04 | 04 | 5 | 48 | 45 | 9 | 39 | 57 |
| Mar. | 2 | 5 | 29 | 09 | -20 | 44 | 50 | 5 | 36 | 28 | -5 | 53 | 59 | 5 | 40 | 25 | -34 | 04 | 05 | 5 | 48 | 45 | -9 | 39 | 57 |
| | 12 | 5 | 29 | 09 | 20 | 44 | 50 | 5 | 36 | 27 | 5 | 53 | 59 | 5 | 40 | 24 | 34 | 04 | 05 | 5 | 48 | 45 | 9 | 39 | 57 |
| | 22 | 5 | 29 | 08 | 20 | 44 | 50 | 5 | 36 | 27 | 5 | 53 | 59 | 5 | 40 | 24 | 34 | 04 | 05 | 5 | 48 | 45 | 9 | 39 | 57 |
| Apr. | 1 | 5 | 29 | 08 | 20 | 44 | 50 | 5 | 36 | 27 | 5 | 53 | 59 | 5 | 40 | 24 | 34 | 04 | 05 | 5 | 48 | 45 | 9 | 39 | 57 |
| | 11 | 5 | 29 | 08 | 20 | 44 | 49 | 5 | 36 | 27 | 5 | 53 | 58 | 5 | 40 | 24 | 34 | 04 | 03 | 5 | 48 | 44 | 9 | 39 | 56 |
| | 21 | 5 | 29 | 08 | 20 | 44 | 47 | 5 | 36 | 27 | 5 | 53 | 57 | 5 | 40 | 24 | 34 | 04 | 02 | 5 | 48 | 44 | 9 | 39 | 56 |
| May | 1 | 5 | 29 | 08 | -20 | 44 | 46 | 5 | 36 | 27 | -5 | 53 | 56 | 5 | 40 | 23 | -34 | 04 | 00 | 5 | 48 | 44 | -9 | 39 | 55 |
| | 11 | 5 | 29 | 08 | 20 | 44 | 44 | 5 | 36 | 27 | 5 | 53 | 55 | 5 | 40 | 23 | 34 | 03 | 58 | 5 | 48 | 44 | 9 | 39 | 53 |
| | 21 | 5 | 29 | 08 | 20 | 44 | 42 | 5 | 36 | 27 | 5 | 53 | 54 | 5 | 40 | 23 | 34 | 03 | 56 | 5 | 48 | 44 | 9 | 39 | 52 |
| | 31 | 5 | 29 | 08 | 20 | 44 | 40 | 5 | 36 | 27 | 5 | 53 | 52 | 5 | 40 | 23 | 34 | 03 | 53 | 5 | 48 | 44 | 9 | 39 | 50 |
| June | 10 | 5 | 29 | 08 | 20 | 44 | 37 | 5 | 36 | 27 | 5 | 53 | 51 | 5 | 40 | 23 | 34 | 03 | 50 | 5 | 48 | 44 | 9 | 39 | 48 |
| | 20 | 5 | 29 | 08 | 20 | 44 | 35 | 5 | 36 | 27 | 5 | 53 | 49 | 5 | 40 | 23 | 34 | 03 | 47 | 5 | 48 | 44 | 9 | 39 | 46 |
| | 30 | 5 | 29 | 08 | -20 | 44 | 32 | 5 | 36 | 27 | -5 | 53 | 47 | 5 | 40 | 23 | -34 | 03 | 44 | 5 | 48 | 44 | -9 | 39 | 44 |
| July | 10 | 5 | 29 | 08 | 20 | 44 | 30 | 5 | 36 | 27 | 5 | 53 | 45 | 5 | 40 | 24 | 34 | 03 | 41 | 5 | 48 | 45 | 9 | 39 | 42 |
| | 20 | 5 | 29 | 08 | 20 | 44 | 27 | 5 | 36 | 27 | 5 | 53 | 43 | 5 | 40 | 24 | 34 | 03 | 38 | 5 | 48 | 45 | 9 | 39 | 40 |
| | 30 | 5 | 29 | 08 | 20 | 44 | 25 | 5 | 36 | 28 | 5 | 53 | 41 | 5 | 40 | 24 | 34 | 03 | 36 | 5 | 48 | 45 | 9 | 39 | 38 |
| Aug. | 9 | 5 | 29 | 09 | 20 | 44 | 23 | 5 | 36 | 28 | 5 | 53 | 40 | 5 | 40 | 24 | 34 | 03 | 33 | 5 | 48 | 45 | 9 | 39 | 37 |
| | 19 | 5 | 29 | 09 | 20 | 44 | 22 | 5 | 36 | 28 | 5 | 53 | 39 | 5 | 40 | 25 | 34 | 03 | 32 | 5 | 48 | 45 | 9 | 39 | 36 |
| | 29 | 5 | 29 | 09 | -20 | 44 | 20 | 5 | 36 | 28 | -5 | 53 | 38 | 5 | 40 | 25 | -34 | 03 | 30 | 5 | 48 | 46 | -9 | 39 | 34 |
| Sept. | 8 | 5 | 29 | 10 | 20 | 44 | 19 | 5 | 36 | 29 | 5 | 53 | 37 | 5 | 40 | 25 | 34 | 03 | 29 | 5 | 48 | 46 | 9 | 39 | 33 |
| | 18 | 5 | 29 | 10 | 20 | 44 | 19 | 5 | 36 | 29 | 5 | 53 | 36 | 5 | 40 | 26 | 34 | 03 | 28 | 5 | 48 | 46 | 9 | 39 | 33 |
| | 28 | 5 | 29 | 10 | 20 | 44 | 19 | 5 | 36 | 29 | 5 | 53 | 36 | 5 | 40 | 26 | 34 | 03 | 29 | 5 | 48 | 47 | 9 | 39 | 33 |
| Oct. | 8 | 5 | 29 | 10 | 20 | 44 | 19 | 5 | 36 | 29 | 5 | 53 | 36 | 5 | 40 | 26 | 34 | 03 | 29 | 5 | 48 | 47 | 9 | 39 | 33 |
| | 18 | 5 | 29 | 11 | 20 | 44 | 20 | 5 | 36 | 30 | 5 | 53 | 37 | 5 | 40 | 26 | 34 | 03 | 30 | 5 | 48 | 47 | 9 | 39 | 34 |
| | 28 | 5 | 29 | 11 | -20 | 44 | 22 | 5 | 36 | 30 | -5 | 53 | 38 | 5 | 40 | 27 | -34 | 03 | 32 | 5 | 48 | 47 | -9 | 39 | 35 |
| Nov. | 7 | 5 | 29 | 11 | 20 | 44 | 24 | 5 | 36 | 30 | 5 | 53 | 39 | 5 | 40 | 27 | 34 | 03 | 34 | 5 | 48 | 48 | 9 | 39 | 37 |
| | 17 | 5 | 29 | 11 | 20 | 44 | 26 | 5 | 36 | 31 | 5 | 53 | 41 | 5 | 40 | 27 | 34 | 03 | 36 | 5 | 48 | 48 | 9 | 39 | 38 |
| | 27 | 5 | 29 | 12 | 20 | 44 | 28 | 5 | 36 | 31 | 5 | 53 | 42 | 5 | 40 | 27 | 34 | 03 | 39 | 5 | 48 | 48 | 9 | 39 | 40 |
| Dec. | 7 | 5 | 29 | 12 | 20 | 44 | 30 | 5 | 36 | 31 | 5 | 53 | 44 | 5 | 40 | 28 | 34 | 03 | 42 | 5 | 48 | 48 | 9 | 39 | 42 |
| | 17 | 5 | 29 | 12 | 20 | 44 | 33 | 5 | 36 | 31 | 5 | 53 | 46 | 5 | 40 | 28 | 34 | 03 | 45 | 5 | 48 | 48 | 9 | 39 | 44 |
| | 27 | 5 | 29 | 12 | -20 | 44 | 35 | 5 | 36 | 31 | -5 | 53 | 47 | 5 | 40 | 28 | -34 | 03 | 48 | 5 | 48 | 49 | -9 | 39 | 45 |
| | 37 | 5 | 29 | 12 | -20 | 44 | 37 | 5 | 36 | 31 | -5 | 53 | 49 | 5 | 40 | 28 | -34 | 03 | 51 | 5 | 48 | 49 | -9 | 39 | 47 |

## APPARENT PLACES OF STARS, 2021

FOR $0^h$ TERRESTRIAL TIME

| Name | | α Orionis | | | | | | ζ Canis Majoris | | | | | | α Carinae | | | | | | γ Geminorum | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mag. Spect. | | 0.4 - 1.3 | | | M2Iab | | | 3.02 | | | B2.5V | | | -0.72 | | | F0II | | | 1.93 | | | A0 IV | | |
| U.T. | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | |
| | | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " |
| Jan. | 1 | 5 | 56 | 19 | +7 | 24 | 34 | 6 | 21 | 08 | -30 | 04 | 26 | 6 | 24 | 27 | -52 | 42 | 28 | 6 | 38 | 56 | +16 | 22 | 47 |
| | 11 | 5 | 56 | 19 | 7 | 24 | 33 | 6 | 21 | 08 | 30 | 04 | 29 | 6 | 24 | 27 | 52 | 42 | 32 | 6 | 38 | 56 | 16 | 22 | 46 |
| | 21 | 5 | 56 | 19 | 7 | 24 | 32 | 6 | 21 | 08 | 30 | 04 | 32 | 6 | 24 | 27 | 52 | 42 | 35 | 6 | 38 | 56 | 16 | 22 | 46 |
| | 31 | 5 | 56 | 19 | 7 | 24 | 32 | 6 | 21 | 08 | 30 | 04 | 34 | 6 | 24 | 27 | 52 | 42 | 37 | 6 | 38 | 56 | 16 | 22 | 46 |
| Feb. | 10 | 5 | 56 | 19 | 7 | 24 | 31 | 6 | 21 | 08 | 30 | 04 | 36 | 6 | 24 | 26 | 52 | 42 | 40 | 6 | 38 | 56 | 16 | 22 | 46 |
| | 20 | 5 | 56 | 19 | 7 | 24 | 31 | 6 | 21 | 08 | 30 | 04 | 37 | 6 | 24 | 26 | 52 | 42 | 42 | 6 | 38 | 56 | 16 | 22 | 46 |
| Mar. | 2 | 5 | 56 | 19 | +7 | 24 | 31 | 6 | 21 | 07 | -30 | 04 | 38 | 6 | 24 | 26 | -52 | 42 | 43 | 6 | 38 | 56 | +16 | 22 | 46 |
| | 12 | 5 | 56 | 18 | 7 | 24 | 31 | 6 | 21 | 07 | 30 | 04 | 39 | 6 | 24 | 25 | 52 | 42 | 44 | 6 | 38 | 55 | 16 | 22 | 47 |
| | 22 | 5 | 56 | 18 | 7 | 24 | 31 | 6 | 21 | 07 | 30 | 04 | 39 | 6 | 24 | 25 | 52 | 42 | 45 | 6 | 38 | 55 | 16 | 22 | 47 |
| Apr. | 1 | 5 | 56 | 18 | 7 | 24 | 31 | 6 | 21 | 07 | 30 | 04 | 39 | 6 | 24 | 25 | 52 | 42 | 45 | 6 | 38 | 55 | 16 | 22 | 47 |
| | 11 | 5 | 56 | 18 | 7 | 24 | 31 | 6 | 21 | 07 | 30 | 04 | 38 | 6 | 24 | 24 | 52 | 42 | 44 | 6 | 38 | 55 | 16 | 22 | 47 |
| | 21 | 5 | 56 | 18 | 7 | 24 | 32 | 6 | 21 | 06 | 30 | 04 | 38 | 6 | 24 | 24 | 52 | 42 | 43 | 6 | 38 | 55 | 16 | 22 | 47 |
| May | 1 | 5 | 56 | 18 | +7 | 24 | 32 | 6 | 21 | 06 | -30 | 04 | 36 | 6 | 24 | 24 | -52 | 42 | 42 | 6 | 38 | 55 | +16 | 22 | 47 |
| | 11 | 5 | 56 | 18 | 7 | 24 | 33 | 6 | 21 | 06 | 30 | 04 | 34 | 6 | 24 | 24 | 52 | 42 | 39 | 6 | 38 | 55 | 16 | 22 | 48 |
| | 21 | 5 | 56 | 18 | 7 | 24 | 33 | 6 | 21 | 06 | 30 | 04 | 32 | 6 | 24 | 23 | 52 | 42 | 37 | 6 | 38 | 54 | 16 | 22 | 48 |
| | 31 | 5 | 56 | 18 | 7 | 24 | 34 | 6 | 21 | 06 | 30 | 04 | 30 | 6 | 24 | 23 | 52 | 42 | 34 | 6 | 38 | 54 | 16 | 22 | 48 |
| June | 10 | 5 | 56 | 18 | 7 | 24 | 35 | 6 | 21 | 06 | 30 | 04 | 28 | 6 | 24 | 23 | 52 | 42 | 31 | 6 | 38 | 54 | 16 | 22 | 48 |
| | 20 | 5 | 56 | 18 | 7 | 24 | 36 | 6 | 21 | 06 | 30 | 04 | 25 | 6 | 24 | 23 | 52 | 42 | 28 | 6 | 38 | 55 | 16 | 22 | 49 |
| | 30 | 5 | 56 | 18 | +7 | 24 | 37 | 6 | 21 | 06 | -30 | 04 | 22 | 6 | 24 | 23 | -52 | 42 | 25 | 6 | 38 | 55 | +16 | 22 | 49 |
| July | 10 | 5 | 56 | 18 | 7 | 24 | 38 | 6 | 21 | 06 | 30 | 04 | 19 | 6 | 24 | 23 | 52 | 42 | 21 | 6 | 38 | 55 | 16 | 22 | 50 |
| | 20 | 5 | 56 | 18 | 7 | 24 | 39 | 6 | 21 | 06 | 30 | 04 | 17 | 6 | 24 | 23 | 52 | 42 | 18 | 6 | 38 | 55 | 16 | 22 | 50 |
| | 30 | 5 | 56 | 18 | 7 | 24 | 40 | 6 | 21 | 07 | 30 | 04 | 14 | 6 | 24 | 24 | 52 | 42 | 15 | 6 | 38 | 55 | 16 | 22 | 51 |
| Aug. | 9 | 5 | 56 | 19 | 7 | 24 | 41 | 6 | 21 | 07 | 30 | 04 | 12 | 6 | 24 | 24 | 52 | 42 | 12 | 6 | 38 | 55 | 16 | 22 | 51 |
| | 19 | 5 | 56 | 19 | 7 | 24 | 42 | 6 | 21 | 07 | 30 | 04 | 10 | 6 | 24 | 24 | 52 | 42 | 10 | 6 | 38 | 56 | 16 | 22 | 51 |
| | 29 | 5 | 56 | 19 | +7 | 24 | 43 | 6 | 21 | 07 | -30 | 04 | 08 | 6 | 24 | 24 | -52 | 42 | 08 | 6 | 38 | 56 | +16 | 22 | 51 |
| Sept. | 8 | 5 | 56 | 20 | 7 | 24 | 44 | 6 | 21 | 08 | 30 | 04 | 07 | 6 | 24 | 25 | 52 | 42 | 06 | 6 | 38 | 56 | 16 | 22 | 52 |
| | 18 | 5 | 56 | 20 | 7 | 24 | 44 | 6 | 21 | 08 | 30 | 04 | 06 | 6 | 24 | 25 | 52 | 42 | 05 | 6 | 38 | 57 | 16 | 22 | 51 |
| | 28 | 5 | 56 | 20 | 7 | 24 | 44 | 6 | 21 | 08 | 30 | 04 | 06 | 6 | 24 | 26 | 52 | 42 | 05 | 6 | 38 | 57 | 16 | 22 | 51 |
| Oct. | 8 | 5 | 56 | 20 | 7 | 24 | 44 | 6 | 21 | 09 | 30 | 04 | 06 | 6 | 24 | 26 | 52 | 42 | 05 | 6 | 38 | 57 | 16 | 22 | 51 |
| | 18 | 5 | 56 | 21 | 7 | 24 | 43 | 6 | 21 | 09 | 30 | 04 | 07 | 6 | 24 | 26 | 52 | 42 | 06 | 6 | 38 | 57 | 16 | 22 | 51 |
| | 28 | 5 | 56 | 21 | +7 | 24 | 43 | 6 | 21 | 09 | -30 | 04 | 09 | 6 | 24 | 27 | -52 | 42 | 08 | 6 | 38 | 58 | +16 | 22 | 50 |
| Nov. | 7 | 5 | 56 | 21 | 7 | 24 | 42 | 6 | 21 | 09 | 30 | 04 | 11 | 6 | 24 | 27 | 52 | 42 | 10 | 6 | 38 | 58 | 16 | 22 | 49 |
| | 17 | 5 | 56 | 22 | 7 | 24 | 41 | 6 | 21 | 10 | 30 | 04 | 13 | 6 | 24 | 28 | 52 | 42 | 12 | 6 | 38 | 58 | 16 | 22 | 49 |
| | 27 | 5 | 56 | 22 | 7 | 24 | 40 | 6 | 21 | 10 | 30 | 04 | 15 | 6 | 24 | 28 | 52 | 42 | 15 | 6 | 38 | 59 | 16 | 22 | 48 |
| Dec. | 7 | 5 | 56 | 22 | 7 | 24 | 39 | 6 | 21 | 10 | 30 | 04 | 18 | 6 | 24 | 28 | 52 | 42 | 19 | 6 | 38 | 59 | 16 | 22 | 47 |
| | 17 | 5 | 56 | 22 | 7 | 24 | 38 | 6 | 21 | 10 | 30 | 04 | 21 | 6 | 24 | 28 | 52 | 42 | 22 | 6 | 38 | 59 | 16 | 22 | 47 |
| | 27 | 5 | 56 | 22 | +7 | 24 | 37 | 6 | 21 | 10 | -30 | 04 | 24 | 6 | 24 | 28 | -52 | 42 | 26 | 6 | 38 | 59 | +16 | 22 | 46 |
| | 37 | 5 | 56 | 22 | +7 | 24 | 37 | 6 | 21 | 10 | -30 | 04 | 27 | 6 | 24 | 28 | -52 | 42 | 29 | 6 | 38 | 59 | +16 | 22 | 46 |

## APPARENT PLACES OF STARS, 2021

FOR $0^h$ TERRESTRIAL TIME

| Name | α Canis Majoris A | | | | | | $o^2$ Canis Majoris | | | | | | β Canis Minoris | | | | | | α Canis Minoris A | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mag. Spect. | -1.46 | | | A1V | | | 3.02 | | | B3 Ia | | | 2.90 | | | B8Ve | | | 0.38 | | | F5 IV-V | | |
| U.T. | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | |
| | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " |
| Jan. 1 | 6 | 46 | 05 | -16 | 44 | 46 | 7 | 03 | 55 | -23 | 51 | 52 | 7 | 28 | 18 | +8 | 14 | 45 | 7 | 40 | 24 | +5 | 10 | 12 |
| 11 | 6 | 46 | 05 | 16 | 44 | 48 | 7 | 03 | 55 | 23 | 51 | 55 | 7 | 28 | 18 | 8 | 14 | 44 | 7 | 40 | 24 | 5 | 10 | 11 |
| 21 | 6 | 46 | 05 | 16 | 44 | 50 | 7 | 03 | 55 | 23 | 51 | 57 | 7 | 28 | 18 | 8 | 14 | 43 | 7 | 40 | 25 | 5 | 10 | 10 |
| 31 | 6 | 46 | 05 | 16 | 44 | 52 | 7 | 03 | 55 | 23 | 52 | 00 | 7 | 28 | 18 | 8 | 14 | 43 | 7 | 40 | 25 | 5 | 10 | 09 |
| Feb. 10 | 6 | 46 | 05 | 16 | 44 | 54 | 7 | 03 | 55 | 23 | 52 | 02 | 7 | 28 | 18 | 8 | 14 | 42 | 7 | 40 | 25 | 5 | 10 | 08 |
| 20 | 6 | 46 | 05 | 16 | 44 | 55 | 7 | 03 | 55 | 23 | 52 | 03 | 7 | 28 | 18 | 8 | 14 | 42 | 7 | 40 | 25 | 5 | 10 | 08 |
| Mar. 2 | 6 | 46 | 05 | -16 | 44 | 56 | 7 | 03 | 55 | -23 | 52 | 05 | 7 | 28 | 18 | +8 | 14 | 42 | 7 | 40 | 24 | +5 | 10 | 08 |
| 12 | 6 | 46 | 05 | 16 | 44 | 57 | 7 | 03 | 54 | 23 | 52 | 06 | 7 | 28 | 18 | 8 | 14 | 42 | 7 | 40 | 24 | 5 | 10 | 08 |
| 22 | 6 | 46 | 04 | 16 | 44 | 57 | 7 | 03 | 54 | 23 | 52 | 06 | 7 | 28 | 17 | 8 | 14 | 42 | 7 | 40 | 24 | 5 | 10 | 07 |
| Apr. 1 | 6 | 46 | 04 | 16 | 44 | 57 | 7 | 03 | 54 | 23 | 52 | 06 | 7 | 28 | 17 | 8 | 14 | 42 | 7 | 40 | 24 | 5 | 10 | 08 |
| 11 | 6 | 46 | 04 | 16 | 44 | 56 | 7 | 03 | 54 | 23 | 52 | 06 | 7 | 28 | 17 | 8 | 14 | 42 | 7 | 40 | 24 | 5 | 10 | 08 |
| 21 | 6 | 46 | 04 | 16 | 44 | 56 | 7 | 03 | 54 | 23 | 52 | 06 | 7 | 28 | 17 | 8 | 14 | 42 | 7 | 40 | 24 | 5 | 10 | 08 |
| May 1 | 6 | 46 | 04 | -16 | 44 | 55 | 7 | 03 | 53 | -23 | 52 | 05 | 7 | 28 | 17 | +8 | 14 | 43 | 7 | 40 | 24 | +5 | 10 | 09 |
| 11 | 6 | 46 | 04 | 16 | 44 | 54 | 7 | 03 | 53 | 23 | 52 | 03 | 7 | 28 | 17 | 8 | 14 | 43 | 7 | 40 | 23 | 5 | 10 | 09 |
| 21 | 6 | 46 | 03 | 16 | 44 | 52 | 7 | 03 | 53 | 23 | 52 | 02 | 7 | 28 | 17 | 8 | 14 | 44 | 7 | 40 | 23 | 5 | 10 | 10 |
| 31 | 6 | 46 | 03 | 16 | 44 | 51 | 7 | 03 | 53 | 23 | 52 | 00 | 7 | 28 | 17 | 8 | 14 | 44 | 7 | 40 | 23 | 5 | 10 | 10 |
| June 10 | 6 | 46 | 03 | 16 | 44 | 49 | 7 | 03 | 53 | 23 | 51 | 58 | 7 | 28 | 17 | 8 | 14 | 45 | 7 | 40 | 23 | 5 | 10 | 11 |
| 20 | 6 | 46 | 03 | 16 | 44 | 47 | 7 | 03 | 53 | 23 | 51 | 56 | 7 | 28 | 17 | 8 | 14 | 46 | 7 | 40 | 23 | 5 | 10 | 12 |
| 30 | 6 | 46 | 04 | -16 | 44 | 45 | 7 | 03 | 53 | -23 | 51 | 53 | 7 | 28 | 17 | +8 | 14 | 47 | 7 | 40 | 23 | +5 | 10 | 13 |
| July 10 | 6 | 46 | 04 | 16 | 44 | 43 | 7 | 03 | 53 | 23 | 51 | 51 | 7 | 28 | 17 | 8 | 14 | 47 | 7 | 40 | 23 | 5 | 10 | 14 |
| 20 | 6 | 46 | 04 | 16 | 44 | 40 | 7 | 03 | 53 | 23 | 51 | 48 | 7 | 28 | 17 | 8 | 14 | 48 | 7 | 40 | 23 | 5 | 10 | 15 |
| 30 | 6 | 46 | 04 | 16 | 44 | 38 | 7 | 03 | 53 | 23 | 51 | 46 | 7 | 28 | 17 | 8 | 14 | 49 | 7 | 40 | 24 | 5 | 10 | 15 |
| Aug. 9 | 6 | 46 | 04 | 16 | 44 | 36 | 7 | 03 | 54 | 23 | 51 | 44 | 7 | 28 | 17 | 8 | 14 | 49 | 7 | 40 | 24 | 5 | 10 | 16 |
| 19 | 6 | 46 | 04 | 16 | 44 | 35 | 7 | 03 | 54 | 23 | 51 | 42 | 7 | 28 | 17 | 8 | 14 | 50 | 7 | 40 | 24 | 5 | 10 | 16 |
| 29 | 6 | 46 | 05 | -16 | 44 | 34 | 7 | 03 | 54 | -23 | 51 | 40 | 7 | 28 | 18 | +8 | 14 | 50 | 7 | 40 | 24 | +5 | 10 | 17 |
| Sept. 8 | 6 | 46 | 05 | 16 | 44 | 32 | 7 | 03 | 54 | 23 | 51 | 39 | 7 | 28 | 18 | 8 | 14 | 50 | 7 | 40 | 24 | 5 | 10 | 17 |
| 18 | 6 | 46 | 05 | 16 | 44 | 32 | 7 | 03 | 55 | 23 | 51 | 38 | 7 | 28 | 18 | 8 | 14 | 50 | 7 | 40 | 25 | 5 | 10 | 17 |
| 28 | 6 | 46 | 05 | 16 | 44 | 32 | 7 | 03 | 55 | 23 | 51 | 38 | 7 | 28 | 18 | 8 | 14 | 50 | 7 | 40 | 25 | 5 | 10 | 17 |
| Oct. 8 | 6 | 46 | 06 | 16 | 44 | 32 | 7 | 03 | 55 | 23 | 51 | 38 | 7 | 28 | 19 | 8 | 14 | 50 | 7 | 40 | 25 | 5 | 10 | 16 |
| 18 | 6 | 46 | 06 | 16 | 44 | 33 | 7 | 03 | 56 | 23 | 51 | 39 | 7 | 28 | 19 | 8 | 14 | 49 | 7 | 40 | 26 | 5 | 10 | 16 |
| 28 | 6 | 46 | 06 | -16 | 44 | 34 | 7 | 03 | 56 | -23 | 51 | 40 | 7 | 28 | 19 | +8 | 14 | 48 | 7 | 40 | 26 | +5 | 10 | 14 |
| Nov. 7 | 6 | 46 | 07 | 16 | 44 | 36 | 7 | 03 | 56 | 23 | 51 | 42 | 7 | 28 | 20 | 8 | 14 | 47 | 7 | 40 | 26 | 5 | 10 | 13 |
| 17 | 6 | 46 | 07 | 16 | 44 | 38 | 7 | 03 | 56 | 23 | 51 | 43 | 7 | 28 | 20 | 8 | 14 | 46 | 7 | 40 | 26 | 5 | 10 | 12 |
| 27 | 6 | 46 | 07 | 16 | 44 | 40 | 7 | 03 | 57 | 23 | 51 | 46 | 7 | 28 | 20 | 8 | 14 | 44 | 7 | 40 | 27 | 5 | 10 | 10 |
| Dec. 7 | 6 | 46 | 07 | 16 | 44 | 42 | 7 | 03 | 57 | 23 | 51 | 49 | 7 | 28 | 21 | 8 | 14 | 43 | 7 | 40 | 27 | 5 | 10 | 09 |
| 17 | 6 | 46 | 08 | 16 | 44 | 45 | 7 | 03 | 57 | 23 | 51 | 51 | 7 | 28 | 21 | 8 | 14 | 42 | 7 | 40 | 27 | 5 | 10 | 07 |
| 27 | 6 | 46 | 08 | -16 | 44 | 47 | 7 | 03 | 57 | -23 | 51 | 54 | 7 | 28 | 21 | +8 | 14 | 40 | 7 | 40 | 27 | +5 | 10 | 06 |
| 37 | 6 | 46 | 08 | -16 | 44 | 50 | 7 | 03 | 57 | -23 | 51 | 57 | 7 | 28 | 21 | +8 | 14 | 39 | 7 | 40 | 28 | +5 | 10 | 05 |

## APPARENT PLACES OF STARS, 2021

FOR $0^h$ TERRESTRIAL TIME

| Name | | β Geminorum | | | | | | ξ Puppis | | | | | | ρ Puppis | | | | | | ζ Hydrae | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mag. Spect. | | 1.14 | | | K0IIIb | | | 3.34 | | | G6 Ia | | | 2.81 | | | F6IIp | | | 3.11 | | | G9 II-III | | |
| U.T. | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | |
| | | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " |
| Jan. | 1 | 7 | 46 | 36 | +27 | 58 | 25 | 7 | 50 | 11 | -24 | 54 | 44 | 8 | 08 | 27 | -24 | 21 | 51 | 8 | 56 | 30 | +5 | 51 | 54 |
| | 11 | 7 | 46 | 36 | 27 | 58 | 26 | 7 | 50 | 11 | 24 | 54 | 47 | 8 | 08 | 27 | 24 | 21 | 54 | 8 | 56 | 31 | 5 | 51 | 53 |
| | 21 | 7 | 46 | 36 | 27 | 58 | 26 | 7 | 50 | 11 | 24 | 54 | 49 | 8 | 08 | 27 | 24 | 21 | 57 | 8 | 56 | 31 | 5 | 51 | 52 |
| | 31 | 7 | 46 | 37 | 27 | 58 | 27 | 7 | 50 | 12 | 24 | 54 | 52 | 8 | 08 | 27 | 24 | 21 | 59 | 8 | 56 | 31 | 5 | 51 | 51 |
| Feb. | 10 | 7 | 46 | 37 | 27 | 58 | 27 | 7 | 50 | 12 | 24 | 54 | 54 | 8 | 08 | 27 | 24 | 22 | 02 | 8 | 56 | 31 | 5 | 51 | 50 |
| | 20 | 7 | 46 | 37 | 27 | 58 | 28 | 7 | 50 | 11 | 24 | 54 | 56 | 8 | 08 | 27 | 24 | 22 | 04 | 8 | 56 | 31 | 5 | 51 | 49 |
| Mar. | 2 | 7 | 46 | 36 | +27 | 58 | 29 | 7 | 50 | 11 | -24 | 54 | 58 | 8 | 08 | 27 | -24 | 22 | 05 | 8 | 56 | 31 | +5 | 51 | 49 |
| | 12 | 7 | 46 | 36 | 27 | 58 | 29 | 7 | 50 | 11 | 24 | 54 | 59 | 8 | 08 | 27 | 24 | 22 | 07 | 8 | 56 | 31 | 5 | 51 | 49 |
| | 22 | 7 | 46 | 36 | 27 | 58 | 30 | 7 | 50 | 11 | 24 | 55 | 00 | 8 | 08 | 27 | 24 | 22 | 08 | 8 | 56 | 31 | 5 | 51 | 48 |
| Apr. | 1 | 7 | 46 | 36 | 27 | 58 | 31 | 7 | 50 | 11 | 24 | 55 | 00 | 8 | 08 | 27 | 24 | 22 | 09 | 8 | 56 | 31 | 5 | 51 | 49 |
| | 11 | 7 | 46 | 36 | 27 | 58 | 31 | 7 | 50 | 11 | 24 | 55 | 01 | 8 | 08 | 26 | 24 | 22 | 09 | 8 | 56 | 30 | 5 | 51 | 49 |
| | 21 | 7 | 46 | 36 | 27 | 58 | 31 | 7 | 50 | 10 | 24 | 55 | 01 | 8 | 08 | 26 | 24 | 22 | 09 | 8 | 56 | 30 | 5 | 51 | 49 |
| May | 1 | 7 | 46 | 35 | +27 | 58 | 32 | 7 | 50 | 10 | -24 | 55 | 00 | 8 | 08 | 26 | -24 | 22 | 09 | 8 | 56 | 30 | +5 | 51 | 50 |
| | 11 | 7 | 46 | 35 | 27 | 58 | 32 | 7 | 50 | 10 | 24 | 54 | 59 | 8 | 08 | 26 | 24 | 22 | 08 | 8 | 56 | 30 | 5 | 51 | 50 |
| | 21 | 7 | 46 | 35 | 27 | 58 | 32 | 7 | 50 | 10 | 24 | 54 | 58 | 8 | 08 | 26 | 24 | 22 | 07 | 8 | 56 | 30 | 5 | 51 | 51 |
| | 31 | 7 | 46 | 35 | 27 | 58 | 31 | 7 | 50 | 10 | 24 | 54 | 56 | 8 | 08 | 26 | 24 | 22 | 05 | 8 | 56 | 30 | 5 | 51 | 51 |
| June | 10 | 7 | 46 | 35 | 27 | 58 | 31 | 7 | 50 | 10 | 24 | 54 | 54 | 8 | 08 | 25 | 24 | 22 | 04 | 8 | 56 | 30 | 5 | 51 | 52 |
| | 20 | 7 | 46 | 35 | 27 | 58 | 31 | 7 | 50 | 10 | 24 | 54 | 52 | 8 | 08 | 25 | 24 | 22 | 01 | 8 | 56 | 30 | 5 | 51 | 53 |
| | 30 | 7 | 46 | 35 | +27 | 58 | 31 | 7 | 50 | 10 | -24 | 54 | 50 | 8 | 08 | 25 | -24 | 22 | 00 | 8 | 56 | 30 | +5 | 51 | 53 |
| July | 10 | 7 | 46 | 35 | 27 | 58 | 30 | 7 | 50 | 10 | 24 | 54 | 48 | 8 | 08 | 25 | 24 | 21 | 57 | 8 | 56 | 30 | 5 | 51 | 54 |
| | 20 | 7 | 46 | 35 | 27 | 58 | 30 | 7 | 50 | 10 | 24 | 54 | 46 | 8 | 08 | 25 | 24 | 21 | 55 | 8 | 56 | 30 | 5 | 51 | 55 |
| | 30 | 7 | 46 | 36 | 27 | 58 | 29 | 7 | 50 | 10 | 24 | 54 | 43 | 8 | 08 | 26 | 24 | 21 | 53 | 8 | 56 | 30 | 5 | 51 | 55 |
| Aug. | 9 | 7 | 46 | 36 | 27 | 58 | 28 | 7 | 50 | 10 | 24 | 54 | 41 | 8 | 08 | 26 | 24 | 21 | 51 | 8 | 56 | 30 | 5 | 51 | 56 |
| | 19 | 7 | 46 | 36 | 27 | 58 | 28 | 7 | 50 | 10 | 24 | 54 | 39 | 8 | 08 | 26 | 24 | 21 | 49 | 8 | 56 | 30 | 5 | 51 | 56 |
| | 29 | 7 | 46 | 36 | +27 | 58 | 27 | 7 | 50 | 10 | -24 | 54 | 37 | 8 | 08 | 26 | -24 | 21 | 47 | 8 | 56 | 30 | +5 | 51 | 56 |
| Sept. | 8 | 7 | 46 | 36 | 27 | 58 | 26 | 7 | 50 | 11 | 24 | 54 | 36 | 8 | 08 | 26 | 24 | 21 | 45 | 8 | 56 | 30 | 5 | 51 | 56 |
| | 18 | 7 | 46 | 37 | 27 | 58 | 26 | 7 | 50 | 11 | 24 | 54 | 35 | 8 | 08 | 27 | 24 | 21 | 45 | 8 | 56 | 31 | 5 | 51 | 56 |
| | 28 | 7 | 46 | 37 | 27 | 58 | 25 | 7 | 50 | 11 | 24 | 54 | 34 | 8 | 08 | 27 | 24 | 21 | 44 | 8 | 56 | 31 | 5 | 51 | 55 |
| Oct. | 8 | 7 | 46 | 37 | 27 | 58 | 24 | 7 | 50 | 11 | 24 | 54 | 34 | 8 | 08 | 27 | 24 | 21 | 44 | 8 | 56 | 31 | 5 | 51 | 55 |
| | 18 | 7 | 46 | 38 | 27 | 58 | 23 | 7 | 50 | 12 | 24 | 54 | 35 | 8 | 08 | 27 | 24 | 21 | 44 | 8 | 56 | 31 | 5 | 51 | 54 |
| | 28 | 7 | 46 | 38 | +27 | 58 | 22 | 7 | 50 | 12 | -24 | 54 | 36 | 8 | 08 | 28 | -24 | 21 | 45 | 8 | 56 | 32 | +5 | 51 | 52 |
| Nov. | 7 | 7 | 46 | 38 | 27 | 58 | 21 | 7 | 50 | 12 | 24 | 54 | 37 | 8 | 08 | 28 | 24 | 21 | 46 | 8 | 56 | 32 | 5 | 51 | 51 |
| | 17 | 7 | 46 | 39 | 27 | 58 | 20 | 7 | 50 | 13 | 24 | 54 | 39 | 8 | 08 | 28 | 24 | 21 | 48 | 8 | 56 | 32 | 5 | 51 | 50 |
| | 27 | 7 | 46 | 39 | 27 | 58 | 20 | 7 | 50 | 13 | 24 | 54 | 41 | 8 | 08 | 29 | 24 | 21 | 50 | 8 | 56 | 33 | 5 | 51 | 48 |
| Dec. | 7 | 7 | 46 | 39 | 27 | 58 | 19 | 7 | 50 | 13 | 24 | 54 | 44 | 8 | 08 | 29 | 24 | 21 | 53 | 8 | 56 | 33 | 5 | 51 | 46 |
| | 17 | 7 | 46 | 40 | 27 | 58 | 19 | 7 | 50 | 14 | 24 | 54 | 47 | 8 | 08 | 29 | 24 | 21 | 56 | 8 | 56 | 33 | 5 | 51 | 44 |
| | 27 | 7 | 46 | 40 | +27 | 58 | 19 | 7 | 50 | 14 | -24 | 54 | 49 | 8 | 08 | 29 | -24 | 21 | 58 | 8 | 56 | 33 | +5 | 51 | 43 |
| | 37 | 7 | 46 | 40 | +27 | 58 | 19 | 7 | 50 | 14 | -24 | 54 | 52 | 8 | 08 | 30 | -24 | 22 | 01 | 8 | 56 | 34 | +5 | 51 | 41 |

## APPARENT PLACES OF STARS, 2021

FOR $0^h$ TERRESTRIAL TIME

| Name | | λ Velorum | | | | | | α Hydrae | | | | | | α Leonis | | | | | | α Antliae | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mag. Spect. | | 2.21 | | | K4 Ib-II | | | 1.98 | | | K3 II-III | | | 1.35 | | | B7 V | | | 4.25 | | | K4 III | | |
| U.T. | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | |
| | | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " |
| Jan. | 1 | 9 | 08 | 47 | -43 | 30 | 52 | 9 | 28 | 37 | -8 | 44 | 56 | 10 | 09 | 29 | +11 | 51 | 51 | 10 | 28 | 07 | -31 | 10 | 17 |
| | 11 | 9 | 08 | 47 | 43 | 30 | 56 | 9 | 28 | 37 | 8 | 44 | 58 | 10 | 09 | 29 | 11 | 51 | 50 | 10 | 28 | 07 | 31 | 10 | 20 |
| | 21 | 9 | 08 | 47 | 43 | 30 | 59 | 9 | 28 | 38 | 8 | 45 | 00 | 10 | 09 | 30 | 11 | 51 | 49 | 10 | 28 | 07 | 31 | 10 | 23 |
| | 31 | 9 | 08 | 47 | 43 | 31 | 02 | 9 | 28 | 38 | 8 | 45 | 02 | 10 | 09 | 30 | 11 | 51 | 48 | 10 | 28 | 08 | 31 | 10 | 26 |
| Feb. | 10 | 9 | 08 | 47 | 43 | 31 | 06 | 9 | 28 | 38 | 8 | 45 | 04 | 10 | 09 | 30 | 11 | 51 | 47 | 10 | 28 | 08 | 31 | 10 | 29 |
| | 20 | 9 | 08 | 47 | 43 | 31 | 09 | 9 | 28 | 38 | 8 | 45 | 05 | 10 | 09 | 30 | 11 | 51 | 47 | 10 | 28 | 08 | 31 | 10 | 31 |
| Mar. | 2 | 9 | 08 | 47 | -43 | 31 | 12 | 9 | 28 | 38 | -8 | 45 | 06 | 10 | 09 | 30 | +11 | 51 | 47 | 10 | 28 | 08 | -31 | 10 | 34 |
| | 12 | 9 | 08 | 47 | 43 | 31 | 14 | 9 | 28 | 38 | 8 | 45 | 08 | 10 | 09 | 30 | 11 | 51 | 46 | 10 | 28 | 08 | 31 | 10 | 37 |
| | 22 | 9 | 08 | 47 | 43 | 31 | 17 | 9 | 28 | 38 | 8 | 45 | 08 | 10 | 09 | 30 | 11 | 51 | 47 | 10 | 28 | 08 | 31 | 10 | 39 |
| Apr. | 1 | 9 | 08 | 47 | 43 | 31 | 18 | 9 | 28 | 38 | 8 | 45 | 09 | 10 | 09 | 30 | 11 | 51 | 47 | 10 | 28 | 08 | 31 | 10 | 40 |
| | 11 | 9 | 08 | 47 | 43 | 31 | 20 | 9 | 28 | 38 | 8 | 45 | 09 | 10 | 09 | 30 | 11 | 51 | 48 | 10 | 28 | 08 | 31 | 10 | 42 |
| | 21 | 9 | 08 | 46 | 43 | 31 | 21 | 9 | 28 | 37 | 8 | 45 | 09 | 10 | 09 | 30 | 11 | 51 | 48 | 10 | 28 | 08 | 31 | 10 | 43 |
| May | 1 | 9 | 08 | 46 | -43 | 31 | 21 | 9 | 28 | 37 | -8 | 45 | 09 | 10 | 09 | 30 | +11 | 51 | 49 | 10 | 28 | 07 | -31 | 10 | 44 |
| | 11 | 9 | 08 | 46 | 43 | 31 | 21 | 9 | 28 | 37 | 8 | 45 | 09 | 10 | 09 | 30 | 11 | 51 | 50 | 10 | 28 | 07 | 31 | 10 | 44 |
| | 21 | 9 | 08 | 46 | 43 | 31 | 20 | 9 | 28 | 37 | 8 | 45 | 08 | 10 | 09 | 29 | 11 | 51 | 50 | 10 | 28 | 07 | 31 | 10 | 44 |
| | 31 | 9 | 08 | 46 | 43 | 31 | 19 | 9 | 28 | 37 | 8 | 45 | 07 | 10 | 09 | 29 | 11 | 51 | 51 | 10 | 28 | 07 | 31 | 10 | 44 |
| June | 10 | 9 | 08 | 45 | 43 | 31 | 18 | 9 | 28 | 37 | 8 | 45 | 06 | 10 | 09 | 29 | 11 | 51 | 51 | 10 | 28 | 07 | 31 | 10 | 43 |
| | 20 | 9 | 08 | 45 | 43 | 31 | 16 | 9 | 28 | 37 | 8 | 45 | 05 | 10 | 09 | 29 | 11 | 51 | 52 | 10 | 28 | 07 | 31 | 10 | 42 |
| | 30 | 9 | 08 | 45 | -43 | 31 | 14 | 9 | 28 | 37 | -8 | 45 | 04 | 10 | 09 | 29 | +11 | 51 | 52 | 10 | 28 | 07 | -31 | 10 | 41 |
| July | 10 | 9 | 08 | 45 | 43 | 31 | 12 | 9 | 28 | 37 | 8 | 45 | 03 | 10 | 09 | 29 | 11 | 51 | 52 | 10 | 28 | 06 | 31 | 10 | 40 |
| | 20 | 9 | 08 | 45 | 43 | 31 | 09 | 9 | 28 | 37 | 8 | 45 | 02 | 10 | 09 | 29 | 11 | 51 | 53 | 10 | 28 | 06 | 31 | 10 | 38 |
| | 30 | 9 | 08 | 45 | 43 | 31 | 06 | 9 | 28 | 37 | 8 | 45 | 00 | 10 | 09 | 29 | 11 | 51 | 53 | 10 | 28 | 06 | 31 | 10 | 36 |
| Aug. | 9 | 9 | 08 | 45 | 43 | 31 | 04 | 9 | 28 | 37 | 8 | 44 | 59 | 10 | 09 | 29 | 11 | 51 | 53 | 10 | 28 | 06 | 31 | 10 | 34 |
| | 19 | 9 | 08 | 45 | 43 | 31 | 01 | 9 | 28 | 37 | 8 | 44 | 58 | 10 | 09 | 29 | 11 | 51 | 52 | 10 | 28 | 06 | 31 | 10 | 32 |
| | 29 | 9 | 08 | 45 | -43 | 30 | 58 | 9 | 28 | 37 | -8 | 44 | 57 | 10 | 09 | 29 | +11 | 51 | 52 | 10 | 28 | 06 | -31 | 10 | 30 |
| Sept. | 8 | 9 | 08 | 45 | 43 | 30 | 56 | 9 | 28 | 37 | 8 | 44 | 56 | 10 | 09 | 29 | 11 | 51 | 52 | 10 | 28 | 06 | 31 | 10 | 28 |
| | 18 | 9 | 08 | 46 | 43 | 30 | 54 | 9 | 28 | 37 | 8 | 44 | 56 | 10 | 09 | 29 | 11 | 51 | 51 | 10 | 28 | 06 | 31 | 10 | 27 |
| | 28 | 9 | 08 | 46 | 43 | 30 | 53 | 9 | 28 | 37 | 8 | 44 | 56 | 10 | 09 | 30 | 11 | 51 | 50 | 10 | 28 | 07 | 31 | 10 | 25 |
| Oct. | 8 | 9 | 08 | 46 | 43 | 30 | 52 | 9 | 28 | 38 | 8 | 44 | 56 | 10 | 09 | 30 | 11 | 51 | 49 | 10 | 28 | 07 | 31 | 10 | 24 |
| | 18 | 9 | 08 | 46 | 43 | 30 | 51 | 9 | 28 | 38 | 8 | 44 | 57 | 10 | 09 | 30 | 11 | 51 | 47 | 10 | 28 | 07 | 31 | 10 | 24 |
| | 28 | 9 | 08 | 47 | -43 | 30 | 52 | 9 | 28 | 38 | -8 | 44 | 58 | 10 | 09 | 30 | +11 | 51 | 46 | 10 | 28 | 07 | -31 | 10 | 24 |
| Nov. | 7 | 9 | 08 | 47 | 43 | 30 | 52 | 9 | 28 | 39 | 8 | 44 | 59 | 10 | 09 | 31 | 11 | 51 | 44 | 10 | 28 | 08 | 31 | 10 | 24 |
| | 17 | 9 | 08 | 48 | 43 | 30 | 53 | 9 | 28 | 39 | 8 | 45 | 00 | 10 | 09 | 31 | 11 | 51 | 42 | 10 | 28 | 08 | 31 | 10 | 25 |
| | 27 | 9 | 08 | 48 | 43 | 30 | 55 | 9 | 28 | 39 | 8 | 45 | 02 | 10 | 09 | 31 | 11 | 51 | 40 | 10 | 28 | 08 | 31 | 10 | 27 |
| Dec. | 7 | 9 | 08 | 48 | 43 | 30 | 58 | 9 | 28 | 40 | 8 | 45 | 05 | 10 | 09 | 32 | 11 | 51 | 38 | 10 | 28 | 09 | 31 | 10 | 29 |
| | 17 | 9 | 08 | 49 | 43 | 31 | 01 | 9 | 28 | 40 | 8 | 45 | 07 | 10 | 09 | 32 | 11 | 51 | 37 | 10 | 28 | 09 | 31 | 10 | 31 |
| | 27 | 9 | 08 | 49 | -43 | 31 | 04 | 9 | 28 | 40 | -8 | 45 | 09 | 10 | 09 | 32 | +11 | 51 | 35 | 10 | 28 | 09 | -31 | 10 | 33 |
| | 37 | 9 | 08 | 49 | -43 | 31 | 07 | 9 | 28 | 40 | -8 | 45 | 11 | 10 | 09 | 33 | +11 | 51 | 33 | 10 | 28 | 10 | -31 | 10 | 36 |

## APPARENT PLACES OF STARS, 2021

FOR $0^h$ TERRESTRIAL TIME

| Name | | ν Hydrae | | | | | | ξ Hydrae | | | | | | β Leonis | | | | | | γ Corvi | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mag. Spect. | | 3.11 | | | K0/K1III | | | 3.54 | | | G7 III | | | 2.14 | | | A3 V | | | 2.59 | | | B8III | | |
| U.T. | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | |
| | | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " |
| Jan. | 1 | 10 | 50 | 39 | -16 | 18 | 04 | 11 | 34 | 02 | -31 | 58 | 11 | 11 | 50 | 07 | +14 | 27 | 16 | 12 | 16 | 52 | -17 | 39 | 19 |
| | 11 | 10 | 50 | 40 | 16 | 18 | 07 | 11 | 34 | 02 | 31 | 58 | 13 | 11 | 50 | 07 | 14 | 27 | 15 | 12 | 16 | 53 | 17 | 39 | 21 |
| | 21 | 10 | 50 | 40 | 16 | 18 | 09 | 11 | 34 | 02 | 31 | 58 | 16 | 11 | 50 | 08 | 14 | 27 | 13 | 12 | 16 | 53 | 17 | 39 | 24 |
| | 31 | 10 | 50 | 40 | 16 | 18 | 12 | 11 | 34 | 03 | 31 | 58 | 19 | 11 | 50 | 08 | 14 | 27 | 12 | 12 | 16 | 53 | 17 | 39 | 26 |
| Feb. | 10 | 10 | 50 | 40 | 16 | 18 | 14 | 11 | 34 | 03 | 31 | 58 | 22 | 11 | 50 | 08 | 14 | 27 | 11 | 12 | 16 | 54 | 17 | 39 | 28 |
| | 20 | 10 | 50 | 40 | 16 | 18 | 16 | 11 | 34 | 03 | 31 | 58 | 24 | 11 | 50 | 08 | 14 | 27 | 11 | 12 | 16 | 54 | 17 | 39 | 30 |
| Mar. | 2 | 10 | 50 | 41 | -16 | 18 | 18 | 11 | 34 | 03 | -31 | 58 | 27 | 11 | 50 | 09 | +14 | 27 | 11 | 12 | 16 | 54 | -17 | 39 | 32 |
| | 12 | 10 | 50 | 41 | 16 | 18 | 20 | 11 | 34 | 03 | 31 | 58 | 30 | 11 | 50 | 09 | 14 | 27 | 11 | 12 | 16 | 54 | 17 | 39 | 34 |
| | 22 | 10 | 50 | 41 | 16 | 18 | 21 | 11 | 34 | 03 | 31 | 58 | 32 | 11 | 50 | 09 | 14 | 27 | 11 | 12 | 16 | 54 | 17 | 39 | 36 |
| Apr. | 1 | 10 | 50 | 41 | 16 | 18 | 22 | 11 | 34 | 03 | 31 | 58 | 34 | 11 | 50 | 09 | 14 | 27 | 12 | 12 | 16 | 54 | 17 | 39 | 37 |
| | 11 | 10 | 50 | 41 | 16 | 18 | 23 | 11 | 34 | 03 | 31 | 58 | 36 | 11 | 50 | 09 | 14 | 27 | 13 | 12 | 16 | 54 | 17 | 39 | 38 |
| | 21 | 10 | 50 | 40 | 16 | 18 | 24 | 11 | 34 | 03 | 31 | 58 | 38 | 11 | 50 | 09 | 14 | 27 | 13 | 12 | 16 | 54 | 17 | 39 | 39 |
| May | 1 | 10 | 50 | 40 | -16 | 18 | 24 | 11 | 34 | 03 | -31 | 58 | 39 | 11 | 50 | 09 | +14 | 27 | 14 | 12 | 16 | 54 | -17 | 39 | 40 |
| | 11 | 10 | 50 | 40 | 16 | 18 | 24 | 11 | 34 | 03 | 31 | 58 | 40 | 11 | 50 | 09 | 14 | 27 | 16 | 12 | 16 | 54 | 17 | 39 | 40 |
| | 21 | 10 | 50 | 40 | 16 | 18 | 24 | 11 | 34 | 03 | 31 | 58 | 40 | 11 | 50 | 09 | 14 | 27 | 16 | 12 | 16 | 54 | 17 | 39 | 40 |
| | 31 | 10 | 50 | 40 | 16 | 18 | 23 | 11 | 34 | 03 | 31 | 58 | 40 | 11 | 50 | 08 | 14 | 27 | 17 | 12 | 16 | 54 | 17 | 39 | 40 |
| June | 10 | 10 | 50 | 40 | 16 | 18 | 23 | 11 | 34 | 03 | 31 | 58 | 40 | 11 | 50 | 08 | 14 | 27 | 18 | 12 | 16 | 54 | 17 | 39 | 40 |
| | 20 | 10 | 50 | 40 | 16 | 18 | 22 | 11 | 34 | 02 | 31 | 58 | 40 | 11 | 50 | 08 | 14 | 27 | 19 | 12 | 16 | 54 | 17 | 39 | 40 |
| | 30 | 10 | 50 | 40 | -16 | 18 | 21 | 11 | 34 | 02 | -31 | 58 | 39 | 11 | 50 | 08 | +14 | 27 | 19 | 12 | 16 | 54 | -17 | 39 | 39 |
| July | 10 | 10 | 50 | 40 | 16 | 18 | 20 | 11 | 34 | 02 | 31 | 58 | 38 | 11 | 50 | 08 | 14 | 27 | 19 | 12 | 16 | 54 | 17 | 39 | 38 |
| | 20 | 10 | 50 | 39 | 16 | 18 | 19 | 11 | 34 | 02 | 31 | 58 | 37 | 11 | 50 | 08 | 14 | 27 | 20 | 12 | 16 | 54 | 17 | 39 | 37 |
| | 30 | 10 | 50 | 39 | 16 | 18 | 17 | 11 | 34 | 02 | 31 | 58 | 35 | 11 | 50 | 08 | 14 | 27 | 20 | 12 | 16 | 53 | 17 | 39 | 37 |
| Aug. | 9 | 10 | 50 | 39 | 16 | 18 | 16 | 11 | 34 | 02 | 31 | 58 | 34 | 11 | 50 | 08 | 14 | 27 | 19 | 12 | 16 | 53 | 17 | 39 | 36 |
| | 19 | 10 | 50 | 39 | 16 | 18 | 15 | 11 | 34 | 02 | 31 | 58 | 32 | 11 | 50 | 08 | 14 | 27 | 19 | 12 | 16 | 53 | 17 | 39 | 35 |
| | 29 | 10 | 50 | 39 | -16 | 18 | 14 | 11 | 34 | 02 | -31 | 58 | 30 | 11 | 50 | 08 | +14 | 27 | 18 | 12 | 16 | 53 | -17 | 39 | 34 |
| Sept. | 8 | 10 | 50 | 40 | 16 | 18 | 13 | 11 | 34 | 02 | 31 | 58 | 28 | 11 | 50 | 08 | 14 | 27 | 18 | 12 | 16 | 53 | 17 | 39 | 33 |
| | 18 | 10 | 50 | 40 | 16 | 18 | 12 | 11 | 34 | 02 | 31 | 58 | 27 | 11 | 50 | 08 | 14 | 27 | 16 | 12 | 16 | 53 | 17 | 39 | 32 |
| | 28 | 10 | 50 | 40 | 16 | 18 | 11 | 11 | 34 | 02 | 31 | 58 | 25 | 11 | 50 | 08 | 14 | 27 | 15 | 12 | 16 | 53 | 17 | 39 | 31 |
| Oct. | 8 | 10 | 50 | 40 | 16 | 18 | 11 | 11 | 34 | 02 | 31 | 58 | 24 | 11 | 50 | 08 | 14 | 27 | 14 | 12 | 16 | 53 | 17 | 39 | 31 |
| | 18 | 10 | 50 | 40 | 16 | 18 | 11 | 11 | 34 | 02 | 31 | 58 | 23 | 11 | 50 | 08 | 14 | 27 | 12 | 12 | 16 | 53 | 17 | 39 | 31 |
| | 28 | 10 | 50 | 40 | -16 | 18 | 12 | 11 | 34 | 03 | -31 | 58 | 23 | 11 | 50 | 08 | +14 | 27 | 10 | 12 | 16 | 54 | -17 | 39 | 31 |
| Nov. | 7 | 10 | 50 | 41 | 16 | 18 | 12 | 11 | 34 | 03 | 31 | 58 | 23 | 11 | 50 | 09 | 14 | 27 | 08 | 12 | 16 | 54 | 17 | 39 | 31 |
| | 17 | 10 | 50 | 41 | 16 | 18 | 14 | 11 | 34 | 03 | 31 | 58 | 23 | 11 | 50 | 09 | 14 | 27 | 06 | 12 | 16 | 54 | 17 | 39 | 32 |
| | 27 | 10 | 50 | 41 | 16 | 18 | 15 | 11 | 34 | 03 | 31 | 58 | 24 | 11 | 50 | 09 | 14 | 27 | 03 | 12 | 16 | 54 | 17 | 39 | 34 |
| Dec. | 7 | 10 | 50 | 42 | 16 | 18 | 17 | 11 | 34 | 04 | 31 | 58 | 26 | 11 | 50 | 09 | 14 | 27 | 01 | 12 | 16 | 55 | 17 | 39 | 35 |
| | 17 | 10 | 50 | 42 | 16 | 18 | 19 | 11 | 34 | 04 | 31 | 58 | 28 | 11 | 50 | 10 | 14 | 26 | 59 | 12 | 16 | 55 | 17 | 39 | 37 |
| | 27 | 10 | 50 | 42 | -16 | 18 | 22 | 11 | 34 | 05 | -31 | 58 | 30 | 11 | 50 | 10 | +14 | 26 | 57 | 12 | 16 | 55 | -17 | 39 | 39 |
| | 37 | 10 | 50 | 43 | -16 | 18 | 24 | 11 | 34 | 05 | -31 | 58 | 32 | 11 | 50 | 11 | +14 | 26 | 55 | 12 | 16 | 56 | -17 | 39 | 41 |

## APPARENT PLACES OF STARS, 2021

FOR 0$^h$ TERRESTRIAL TIME

| Name | | β Corvi | | | | | | δ Virginis | | | | | | ε Virginis | | | | | | ι Centauri | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mag. Spect. | | 2.65 | | | G5 II | | | 3.38 | | | M3III | | | 2.83 | | | G8 III | | | 2.75 | | | kA15hA3nA3va | | |
| U.T. | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | |
| | | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " |
| Jan. | 1 | 12 | 35 | 29 | -23 | 30 | 32 | 12 | 56 | 39 | +3 | 17 | 05 | 13 | 03 | 12 | +10 | 50 | 49 | 13 | 21 | 46 | -36 | 49 | 04 |
| | 11 | 12 | 35 | 29 | 23 | 30 | 35 | 12 | 56 | 39 | 3 | 17 | 03 | 13 | 03 | 13 | 10 | 50 | 47 | 13 | 21 | 46 | 36 | 49 | 06 |
| | 21 | 12 | 35 | 29 | 23 | 30 | 37 | 12 | 56 | 39 | 3 | 17 | 01 | 13 | 03 | 13 | 10 | 50 | 45 | 13 | 21 | 46 | 36 | 49 | 08 |
| | 31 | 12 | 35 | 30 | 23 | 30 | 39 | 12 | 56 | 40 | 3 | 16 | 59 | 13 | 03 | 13 | 10 | 50 | 43 | 13 | 21 | 47 | 36 | 49 | 10 |
| Feb. | 10 | 12 | 35 | 30 | 23 | 30 | 42 | 12 | 56 | 40 | 3 | 16 | 57 | 13 | 03 | 14 | 10 | 50 | 42 | 13 | 21 | 47 | 36 | 49 | 13 |
| | 20 | 12 | 35 | 30 | 23 | 30 | 44 | 12 | 56 | 40 | 3 | 16 | 56 | 13 | 03 | 14 | 10 | 50 | 41 | 13 | 21 | 47 | 36 | 49 | 15 |
| Mar. | 2 | 12 | 35 | 30 | -23 | 30 | 46 | 12 | 56 | 40 | +3 | 16 | 55 | 13 | 03 | 14 | +10 | 50 | 40 | 13 | 21 | 48 | -36 | 49 | 18 |
| | 12 | 12 | 35 | 30 | 23 | 30 | 49 | 12 | 56 | 41 | 3 | 16 | 55 | 13 | 03 | 14 | 10 | 50 | 40 | 13 | 21 | 48 | 36 | 49 | 20 |
| | 22 | 12 | 35 | 31 | 23 | 30 | 50 | 12 | 56 | 41 | 3 | 16 | 54 | 13 | 03 | 14 | 10 | 50 | 40 | 13 | 21 | 48 | 36 | 49 | 23 |
| Apr. | 1 | 12 | 35 | 31 | 23 | 30 | 52 | 12 | 56 | 41 | 3 | 16 | 54 | 13 | 03 | 14 | 10 | 50 | 41 | 13 | 21 | 48 | 36 | 49 | 25 |
| | 11 | 12 | 35 | 31 | 23 | 30 | 53 | 12 | 56 | 41 | 3 | 16 | 55 | 13 | 03 | 14 | 10 | 50 | 41 | 13 | 21 | 48 | 36 | 49 | 27 |
| | 21 | 12 | 35 | 31 | 23 | 30 | 55 | 12 | 56 | 41 | 3 | 16 | 55 | 13 | 03 | 14 | 10 | 50 | 42 | 13 | 21 | 48 | 36 | 49 | 29 |
| May | 1 | 12 | 35 | 31 | -23 | 30 | 56 | 12 | 56 | 41 | +3 | 16 | 55 | 13 | 03 | 14 | +10 | 50 | 43 | 13 | 21 | 48 | -36 | 49 | 31 |
| | 11 | 12 | 35 | 31 | 23 | 30 | 56 | 12 | 56 | 41 | 3 | 16 | 56 | 13 | 03 | 14 | 10 | 50 | 44 | 13 | 21 | 48 | 36 | 49 | 32 |
| | 21 | 12 | 35 | 31 | 23 | 30 | 57 | 12 | 56 | 41 | 3 | 16 | 57 | 13 | 03 | 14 | 10 | 50 | 45 | 13 | 21 | 48 | 36 | 49 | 34 |
| | 31 | 12 | 35 | 31 | 23 | 30 | 57 | 12 | 56 | 41 | 3 | 16 | 57 | 13 | 03 | 14 | 10 | 50 | 46 | 13 | 21 | 48 | 36 | 49 | 35 |
| June | 10 | 12 | 35 | 30 | 23 | 30 | 57 | 12 | 56 | 41 | 3 | 16 | 58 | 13 | 03 | 14 | 10 | 50 | 47 | 13 | 21 | 48 | 36 | 49 | 35 |
| | 20 | 12 | 35 | 30 | 23 | 30 | 57 | 12 | 56 | 41 | 3 | 16 | 59 | 13 | 03 | 14 | 10 | 50 | 48 | 13 | 21 | 48 | 36 | 49 | 36 |
| | 30 | 12 | 35 | 30 | -23 | 30 | 57 | 12 | 56 | 40 | +3 | 16 | 59 | 13 | 03 | 14 | +10 | 50 | 49 | 13 | 21 | 48 | -36 | 49 | 36 |
| July | 10 | 12 | 35 | 30 | 23 | 30 | 56 | 12 | 56 | 40 | 3 | 17 | 00 | 13 | 03 | 14 | 10 | 50 | 49 | 13 | 21 | 48 | 36 | 49 | 36 |
| | 20 | 12 | 35 | 30 | 23 | 30 | 55 | 12 | 56 | 40 | 3 | 17 | 01 | 13 | 03 | 14 | 10 | 50 | 50 | 13 | 21 | 48 | 36 | 49 | 35 |
| | 30 | 12 | 35 | 30 | 23 | 30 | 54 | 12 | 56 | 40 | 3 | 17 | 01 | 13 | 03 | 14 | 10 | 50 | 50 | 13 | 21 | 47 | 36 | 49 | 35 |
| Aug. | 9 | 12 | 35 | 30 | 23 | 30 | 53 | 12 | 56 | 40 | 3 | 17 | 01 | 13 | 03 | 14 | 10 | 50 | 50 | 13 | 21 | 47 | 36 | 49 | 34 |
| | 19 | 12 | 35 | 30 | 23 | 30 | 52 | 12 | 56 | 40 | 3 | 17 | 01 | 13 | 03 | 14 | 10 | 50 | 50 | 13 | 21 | 47 | 36 | 49 | 33 |
| | 29 | 12 | 35 | 30 | -23 | 30 | 51 | 12 | 56 | 40 | +3 | 17 | 02 | 13 | 03 | 13 | +10 | 50 | 50 | 13 | 21 | 47 | -36 | 49 | 31 |
| Sept. | 8 | 12 | 35 | 30 | 23 | 30 | 50 | 12 | 56 | 40 | 3 | 17 | 01 | 13 | 03 | 13 | 10 | 50 | 49 | 13 | 21 | 47 | 36 | 49 | 30 |
| | 18 | 12 | 35 | 30 | 23 | 30 | 49 | 12 | 56 | 40 | 3 | 17 | 01 | 13 | 03 | 13 | 10 | 50 | 48 | 13 | 21 | 47 | 36 | 49 | 28 |
| | 28 | 12 | 35 | 30 | 23 | 30 | 48 | 12 | 56 | 40 | 3 | 17 | 00 | 13 | 03 | 13 | 10 | 50 | 47 | 13 | 21 | 47 | 36 | 49 | 27 |
| Oct. | 8 | 12 | 35 | 30 | 23 | 30 | 47 | 12 | 56 | 40 | 3 | 17 | 00 | 13 | 03 | 13 | 10 | 50 | 46 | 13 | 21 | 47 | 36 | 49 | 25 |
| | 18 | 12 | 35 | 30 | 23 | 30 | 46 | 12 | 56 | 40 | 3 | 16 | 58 | 13 | 03 | 14 | 10 | 50 | 44 | 13 | 21 | 47 | 36 | 49 | 24 |
| | 28 | 12 | 35 | 30 | -23 | 30 | 46 | 12 | 56 | 40 | +3 | 16 | 57 | 13 | 03 | 14 | +10 | 50 | 43 | 13 | 21 | 47 | -36 | 49 | 23 |
| Nov. | 7 | 12 | 35 | 30 | 23 | 30 | 46 | 12 | 56 | 40 | 3 | 16 | 55 | 13 | 03 | 14 | 10 | 50 | 41 | 13 | 21 | 47 | 36 | 49 | 22 |
| | 17 | 12 | 35 | 30 | 23 | 30 | 47 | 12 | 56 | 40 | 3 | 16 | 54 | 13 | 03 | 14 | 10 | 50 | 38 | 13 | 21 | 47 | 36 | 49 | 22 |
| | 27 | 12 | 35 | 31 | 23 | 30 | 48 | 12 | 56 | 41 | 3 | 16 | 51 | 13 | 03 | 14 | 10 | 50 | 36 | 13 | 21 | 48 | 36 | 49 | 22 |
| Dec. | 7 | 12 | 35 | 31 | 23 | 30 | 49 | 12 | 56 | 41 | 3 | 16 | 49 | 13 | 03 | 15 | 10 | 50 | 34 | 13 | 21 | 48 | 36 | 49 | 22 |
| | 17 | 12 | 35 | 31 | 23 | 30 | 50 | 12 | 56 | 41 | 3 | 16 | 47 | 13 | 03 | 15 | 10 | 50 | 31 | 13 | 21 | 48 | 36 | 49 | 23 |
| | 27 | 12 | 35 | 32 | -23 | 30 | 52 | 12 | 56 | 42 | +3 | 16 | 45 | 13 | 03 | 15 | +10 | 50 | 29 | 13 | 21 | 49 | -36 | 49 | 24 |
| | 37 | 12 | 35 | 32 | -23 | 30 | 55 | 12 | 56 | 42 | +3 | 16 | 43 | 13 | 03 | 16 | +10 | 50 | 27 | 13 | 21 | 49 | -36 | 49 | 26 |

## APPARENT PLACES OF STARS, 2021

FOR $0^h$ TERRESTRIAL TIME

| Name | | α Virginis | | | | | | θ Centauri | | | | | | $\alpha^2$ Librae | | | | | | β Lupi | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mag. Spect. | | 0.98 | | | B1 III-V+ | | | 2.06 | | | K0 III | | | 2.75 | | | KA2HA5MA4IV-V | | | 2.68 | | | B2 III | | |
| U.T. | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | |
| | | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " |
| Jan. | 1 | 13 | 26 | 17 | -11 | 16 | 05 | 14 | 07 | 54 | -36 | 28 | 05 | 14 | 52 | 01 | -16 | 07 | 33 | 14 | 59 | 53 | -43 | 12 | 47 |
| | 11 | 13 | 26 | 17 | 11 | 16 | 07 | 14 | 07 | 54 | 36 | 28 | 07 | 14 | 52 | 01 | 16 | 07 | 35 | 14 | 59 | 53 | 43 | 12 | 48 |
| | 21 | 13 | 26 | 17 | 11 | 16 | 09 | 14 | 07 | 54 | 36 | 28 | 08 | 14 | 52 | 01 | 16 | 07 | 36 | 14 | 59 | 53 | 43 | 12 | 49 |
| | 31 | 13 | 26 | 18 | 11 | 16 | 11 | 14 | 07 | 55 | 36 | 28 | 10 | 14 | 52 | 02 | 16 | 07 | 38 | 14 | 59 | 54 | 43 | 12 | 50 |
| Feb. | 10 | 13 | 26 | 18 | 11 | 16 | 13 | 14 | 07 | 55 | 36 | 28 | 12 | 14 | 52 | 02 | 16 | 07 | 40 | 14 | 59 | 54 | 43 | 12 | 52 |
| | 20 | 13 | 26 | 18 | 11 | 16 | 15 | 14 | 07 | 56 | 36 | 28 | 14 | 14 | 52 | 02 | 16 | 07 | 41 | 14 | 59 | 55 | 43 | 12 | 53 |
| Mar. | 2 | 13 | 26 | 19 | -11 | 16 | 17 | 14 | 07 | 56 | -36 | 28 | 17 | 14 | 52 | 03 | -16 | 07 | 43 | 14 | 59 | 55 | -43 | 12 | 55 |
| | 12 | 13 | 26 | 19 | 11 | 16 | 18 | 14 | 07 | 56 | 36 | 28 | 19 | 14 | 52 | 03 | 16 | 07 | 44 | 14 | 59 | 55 | 43 | 12 | 57 |
| | 22 | 13 | 26 | 19 | 11 | 16 | 19 | 14 | 07 | 56 | 36 | 28 | 21 | 14 | 52 | 03 | 16 | 07 | 45 | 14 | 59 | 56 | 43 | 12 | 59 |
| Apr. | 1 | 13 | 26 | 19 | 11 | 16 | 20 | 14 | 07 | 57 | 36 | 28 | 23 | 14 | 52 | 03 | 16 | 07 | 46 | 14 | 59 | 56 | 43 | 13 | 01 |
| | 11 | 13 | 26 | 19 | 11 | 16 | 21 | 14 | 07 | 57 | 36 | 28 | 25 | 14 | 52 | 04 | 16 | 07 | 47 | 14 | 59 | 56 | 43 | 13 | 03 |
| | 21 | 13 | 26 | 19 | 11 | 16 | 21 | 14 | 07 | 57 | 36 | 28 | 27 | 14 | 52 | 04 | 16 | 07 | 48 | 14 | 59 | 56 | 43 | 13 | 05 |
| May | 1 | 13 | 26 | 19 | -11 | 16 | 21 | 14 | 07 | 57 | -36 | 28 | 29 | 14 | 52 | 04 | -16 | 07 | 48 | 14 | 59 | 57 | -43 | 13 | 07 |
| | 11 | 13 | 26 | 19 | 11 | 16 | 21 | 14 | 07 | 57 | 36 | 28 | 30 | 14 | 52 | 04 | 16 | 07 | 48 | 14 | 59 | 57 | 43 | 13 | 09 |
| | 21 | 13 | 26 | 19 | 11 | 16 | 22 | 14 | 07 | 57 | 36 | 28 | 32 | 14 | 52 | 04 | 16 | 07 | 49 | 14 | 59 | 57 | 43 | 13 | 11 |
| | 31 | 13 | 26 | 19 | 11 | 16 | 21 | 14 | 07 | 57 | 36 | 28 | 33 | 14 | 52 | 04 | 16 | 07 | 49 | 14 | 59 | 57 | 43 | 13 | 13 |
| June | 10 | 13 | 26 | 19 | 11 | 16 | 21 | 14 | 07 | 57 | 36 | 28 | 34 | 14 | 52 | 04 | 16 | 07 | 48 | 14 | 59 | 57 | 43 | 13 | 14 |
| | 20 | 13 | 26 | 19 | 11 | 16 | 21 | 14 | 07 | 57 | 36 | 28 | 35 | 14 | 52 | 04 | 16 | 07 | 48 | 14 | 59 | 57 | 43 | 13 | 15 |
| | 30 | 13 | 26 | 19 | -11 | 16 | 20 | 14 | 07 | 57 | -36 | 28 | 35 | 14 | 52 | 04 | -16 | 07 | 48 | 14 | 59 | 57 | -43 | 13 | 16 |
| July | 10 | 13 | 26 | 19 | 11 | 16 | 20 | 14 | 07 | 57 | 36 | 28 | 35 | 14 | 52 | 04 | 16 | 07 | 48 | 14 | 59 | 57 | 43 | 13 | 17 |
| | 20 | 13 | 26 | 19 | 11 | 16 | 19 | 14 | 07 | 56 | 36 | 28 | 35 | 14 | 52 | 04 | 16 | 07 | 48 | 14 | 59 | 56 | 43 | 13 | 17 |
| | 30 | 13 | 26 | 19 | 11 | 16 | 19 | 14 | 07 | 56 | 36 | 28 | 35 | 14 | 52 | 04 | 16 | 07 | 48 | 14 | 59 | 56 | 43 | 13 | 18 |
| Aug. | 9 | 13 | 26 | 19 | 11 | 16 | 18 | 14 | 07 | 56 | 36 | 28 | 34 | 14 | 52 | 04 | 16 | 07 | 47 | 14 | 59 | 56 | 43 | 13 | 18 |
| | 19 | 13 | 26 | 18 | 11 | 16 | 17 | 14 | 07 | 56 | 36 | 28 | 34 | 14 | 52 | 03 | 16 | 07 | 47 | 14 | 59 | 56 | 43 | 13 | 17 |
| | 29 | 13 | 26 | 18 | -11 | 16 | 17 | 14 | 07 | 56 | -36 | 28 | 32 | 14 | 52 | 03 | -16 | 07 | 46 | 14 | 59 | 56 | -43 | 13 | 16 |
| Sept. | 8 | 13 | 26 | 18 | 11 | 16 | 16 | 14 | 07 | 56 | 36 | 28 | 31 | 14 | 52 | 03 | 16 | 07 | 46 | 14 | 59 | 55 | 43 | 13 | 16 |
| | 18 | 13 | 26 | 18 | 11 | 16 | 16 | 14 | 07 | 56 | 36 | 28 | 30 | 14 | 52 | 03 | 16 | 07 | 45 | 14 | 59 | 55 | 43 | 13 | 14 |
| | 28 | 13 | 26 | 18 | 11 | 16 | 16 | 14 | 07 | 55 | 36 | 28 | 29 | 14 | 52 | 03 | 16 | 07 | 45 | 14 | 59 | 55 | 43 | 13 | 13 |
| Oct. | 8 | 13 | 26 | 18 | 11 | 16 | 16 | 14 | 07 | 55 | 36 | 28 | 27 | 14 | 52 | 03 | 16 | 07 | 45 | 14 | 59 | 55 | 43 | 13 | 12 |
| | 18 | 13 | 26 | 18 | 11 | 16 | 16 | 14 | 07 | 55 | 36 | 28 | 26 | 14 | 52 | 03 | 16 | 07 | 45 | 14 | 59 | 55 | 43 | 13 | 10 |
| | 28 | 13 | 26 | 18 | -11 | 16 | 16 | 14 | 07 | 55 | -36 | 28 | 25 | 14 | 52 | 03 | -16 | 07 | 45 | 14 | 59 | 55 | -43 | 13 | 09 |
| Nov. | 7 | 13 | 26 | 19 | 11 | 16 | 17 | 14 | 07 | 56 | 36 | 28 | 24 | 14 | 52 | 03 | 16 | 07 | 45 | 14 | 59 | 55 | 43 | 13 | 07 |
| | 17 | 13 | 26 | 19 | 11 | 16 | 18 | 14 | 07 | 56 | 36 | 28 | 23 | 14 | 52 | 03 | 16 | 07 | 45 | 14 | 59 | 55 | 43 | 13 | 06 |
| | 27 | 13 | 26 | 19 | 11 | 16 | 19 | 14 | 07 | 56 | 36 | 28 | 23 | 14 | 52 | 03 | 16 | 07 | 46 | 14 | 59 | 55 | 43 | 13 | 05 |
| Dec. | 7 | 13 | 26 | 19 | 11 | 16 | 21 | 14 | 07 | 56 | 36 | 28 | 23 | 14 | 52 | 03 | 16 | 07 | 47 | 14 | 59 | 56 | 43 | 13 | 04 |
| | 17 | 13 | 26 | 20 | 11 | 16 | 23 | 14 | 07 | 57 | 36 | 28 | 24 | 14 | 52 | 04 | 16 | 07 | 48 | 14 | 59 | 56 | 43 | 13 | 04 |
| | 27 | 13 | 26 | 20 | -11 | 16 | 25 | 14 | 07 | 57 | -36 | 28 | 25 | 14 | 52 | 04 | -16 | 07 | 50 | 14 | 59 | 56 | -43 | 13 | 04 |
| | 37 | 13 | 26 | 20 | -11 | 16 | 27 | 14 | 07 | 57 | -36 | 28 | 26 | 14 | 52 | 04 | -16 | 07 | 51 | 14 | 59 | 57 | -43 | 13 | 05 |

## APPARENT PLACES OF STARS, 2021

FOR 0$^h$ TERRESTRIAL TIME

| Name | | β Librae | | | | | | α Serpentis | | | | | | δ Scorpii | | | | | | δ Ophiuchi | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mag. Spect. | | 2.61 | | | B8 IV | | | 2.65 | | | K2 III b | | | 2.32 | | | B0.2 Ive | | | 2.74 | | | M0.5 III | | |
| U.T. | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | |
| | | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " |
| Jan. | 1 | 15 | 18 | 06 | -9 | 27 | 29 | 15 | 45 | 16 | +6 | 21 | 38 | 16 | 01 | 32 | -22 | 40 | 42 | 16 | 15 | 25 | -3 | 44 | 48 |
| | 11 | 15 | 18 | 07 | 9 | 27 | 30 | 15 | 45 | 17 | 6 | 21 | 36 | 16 | 01 | 33 | 22 | 40 | 43 | 16 | 15 | 25 | 3 | 44 | 50 |
| | 21 | 15 | 18 | 07 | 9 | 27 | 32 | 15 | 45 | 17 | 6 | 21 | 34 | 16 | 01 | 33 | 22 | 40 | 44 | 16 | 15 | 25 | 3 | 44 | 51 |
| | 31 | 15 | 18 | 07 | 9 | 27 | 34 | 15 | 45 | 17 | 6 | 21 | 32 | 16 | 01 | 33 | 22 | 40 | 45 | 16 | 15 | 26 | 3 | 44 | 53 |
| Feb. | 10 | 15 | 18 | 08 | 9 | 27 | 35 | 15 | 45 | 18 | 6 | 21 | 31 | 16 | 01 | 34 | 22 | 40 | 46 | 16 | 15 | 26 | 3 | 44 | 54 |
| | 20 | 15 | 18 | 08 | 9 | 27 | 37 | 15 | 45 | 18 | 6 | 21 | 30 | 16 | 01 | 34 | 22 | 40 | 47 | 16 | 15 | 26 | 3 | 44 | 56 |
| Mar. | 2 | 15 | 18 | 08 | -9 | 27 | 38 | 15 | 45 | 18 | +6 | 21 | 28 | 16 | 01 | 34 | -22 | 40 | 49 | 16 | 15 | 27 | -3 | 44 | 57 |
| | 12 | 15 | 18 | 09 | 9 | 27 | 39 | 15 | 45 | 18 | 6 | 21 | 28 | 16 | 01 | 35 | 22 | 40 | 50 | 16 | 15 | 27 | 3 | 44 | 57 |
| | 22 | 15 | 18 | 09 | 9 | 27 | 39 | 15 | 45 | 19 | 6 | 21 | 28 | 16 | 01 | 35 | 22 | 40 | 51 | 16 | 15 | 27 | 3 | 44 | 58 |
| Apr. | 1 | 15 | 18 | 09 | 9 | 27 | 40 | 15 | 45 | 19 | 6 | 21 | 28 | 16 | 01 | 35 | 22 | 40 | 52 | 16 | 15 | 27 | 3 | 44 | 58 |
| | 11 | 15 | 18 | 09 | 9 | 27 | 41 | 15 | 45 | 19 | 6 | 21 | 28 | 16 | 01 | 36 | 22 | 40 | 52 | 16 | 15 | 28 | 3 | 44 | 58 |
| | 21 | 15 | 18 | 09 | 9 | 27 | 41 | 15 | 45 | 19 | 6 | 21 | 29 | 16 | 01 | 36 | 22 | 40 | 53 | 16 | 15 | 28 | 3 | 44 | 58 |
| May | 1 | 15 | 18 | 10 | -9 | 27 | 41 | 15 | 45 | 19 | +6 | 21 | 30 | 16 | 01 | 36 | -22 | 40 | 54 | 16 | 15 | 28 | -3 | 44 | 57 |
| | 11 | 15 | 18 | 10 | 9 | 27 | 40 | 15 | 45 | 20 | 6 | 21 | 31 | 16 | 01 | 36 | 22 | 40 | 54 | 16 | 15 | 28 | 3 | 44 | 56 |
| | 21 | 15 | 18 | 10 | 9 | 27 | 40 | 15 | 45 | 20 | 6 | 21 | 32 | 16 | 01 | 36 | 22 | 40 | 55 | 16 | 15 | 28 | 3 | 44 | 56 |
| | 31 | 15 | 18 | 10 | 9 | 27 | 40 | 15 | 45 | 20 | 6 | 21 | 34 | 16 | 01 | 36 | 22 | 40 | 55 | 16 | 15 | 28 | 3 | 44 | 55 |
| June | 10 | 15 | 18 | 10 | 9 | 27 | 39 | 15 | 45 | 20 | 6 | 21 | 35 | 16 | 01 | 36 | 22 | 40 | 55 | 16 | 15 | 29 | 3 | 44 | 54 |
| | 20 | 15 | 18 | 10 | 9 | 27 | 39 | 15 | 45 | 20 | 6 | 21 | 36 | 16 | 01 | 36 | 22 | 40 | 56 | 16 | 15 | 29 | 3 | 44 | 53 |
| | 30 | 15 | 18 | 10 | -9 | 27 | 39 | 15 | 45 | 20 | +6 | 21 | 37 | 16 | 01 | 37 | -22 | 40 | 56 | 16 | 15 | 29 | -3 | 44 | 53 |
| July | 10 | 15 | 18 | 10 | 9 | 27 | 38 | 15 | 45 | 20 | 6 | 21 | 38 | 16 | 01 | 36 | 22 | 40 | 56 | 16 | 15 | 29 | 3 | 44 | 52 |
| | 20 | 15 | 18 | 10 | 9 | 27 | 38 | 15 | 45 | 20 | 6 | 21 | 39 | 16 | 01 | 36 | 22 | 40 | 56 | 16 | 15 | 28 | 3 | 44 | 51 |
| | 30 | 15 | 18 | 10 | 9 | 27 | 38 | 15 | 45 | 20 | 6 | 21 | 40 | 16 | 01 | 36 | 22 | 40 | 56 | 16 | 15 | 28 | 3 | 44 | 51 |
| Aug. | 9 | 15 | 18 | 09 | 9 | 27 | 37 | 15 | 45 | 19 | 6 | 21 | 40 | 16 | 01 | 36 | 22 | 40 | 56 | 16 | 15 | 28 | 3 | 44 | 50 |
| | 19 | 15 | 18 | 09 | 9 | 27 | 37 | 15 | 45 | 19 | 6 | 21 | 41 | 16 | 01 | 36 | 22 | 40 | 56 | 16 | 15 | 28 | 3 | 44 | 50 |
| | 29 | 15 | 18 | 09 | -9 | 27 | 36 | 15 | 45 | 19 | +6 | 21 | 41 | 16 | 01 | 36 | -22 | 40 | 55 | 16 | 15 | 28 | -3 | 44 | 50 |
| Sept. | 8 | 15 | 18 | 09 | 9 | 27 | 36 | 15 | 45 | 19 | 6 | 21 | 41 | 16 | 01 | 36 | 22 | 40 | 55 | 16 | 15 | 28 | 3 | 44 | 50 |
| | 18 | 15 | 18 | 09 | 9 | 27 | 36 | 15 | 45 | 19 | 6 | 21 | 41 | 16 | 01 | 36 | 22 | 40 | 55 | 16 | 15 | 28 | 3 | 44 | 50 |
| | 28 | 15 | 18 | 09 | 9 | 27 | 36 | 15 | 45 | 19 | 6 | 21 | 40 | 16 | 01 | 35 | 22 | 40 | 54 | 16 | 15 | 28 | 3 | 44 | 50 |
| Oct. | 8 | 15 | 18 | 09 | 9 | 27 | 36 | 15 | 45 | 19 | 6 | 21 | 39 | 16 | 01 | 35 | 22 | 40 | 54 | 16 | 15 | 27 | 3 | 44 | 50 |
| | 18 | 15 | 18 | 09 | 9 | 27 | 36 | 15 | 45 | 19 | 6 | 21 | 38 | 16 | 01 | 35 | 22 | 40 | 54 | 16 | 15 | 27 | 3 | 44 | 51 |
| | 28 | 15 | 18 | 09 | -9 | 27 | 37 | 15 | 45 | 18 | +6 | 21 | 37 | 16 | 01 | 35 | -22 | 40 | 53 | 16 | 15 | 27 | -3 | 44 | 51 |
| Nov. | 7 | 15 | 18 | 09 | 9 | 27 | 37 | 15 | 45 | 18 | 6 | 21 | 36 | 16 | 01 | 35 | 22 | 40 | 53 | 16 | 15 | 27 | 3 | 44 | 52 |
| | 17 | 15 | 18 | 09 | 9 | 27 | 38 | 15 | 45 | 19 | 6 | 21 | 34 | 16 | 01 | 35 | 22 | 40 | 53 | 16 | 15 | 27 | 3 | 44 | 53 |
| | 27 | 15 | 18 | 09 | 9 | 27 | 39 | 15 | 45 | 19 | 6 | 21 | 32 | 16 | 01 | 35 | 22 | 40 | 53 | 16 | 15 | 27 | 3 | 44 | 54 |
| Dec. | 7 | 15 | 18 | 09 | 9 | 27 | 40 | 15 | 45 | 19 | 6 | 21 | 30 | 16 | 01 | 35 | 22 | 40 | 53 | 16 | 15 | 28 | 3 | 44 | 56 |
| | 17 | 15 | 18 | 09 | 9 | 27 | 42 | 15 | 45 | 19 | 6 | 21 | 28 | 16 | 01 | 36 | 22 | 40 | 54 | 16 | 15 | 28 | 3 | 44 | 57 |
| | 27 | 15 | 18 | 10 | -9 | 27 | 44 | 15 | 45 | 19 | +6 | 21 | 26 | 16 | 01 | 36 | -22 | 40 | 55 | 16 | 15 | 28 | -3 | 44 | 59 |
| | 37 | 15 | 18 | 10 | -9 | 27 | 45 | 15 | 45 | 20 | +6 | 21 | 23 | 16 | 01 | 36 | -22 | 40 | 55 | 16 | 15 | 28 | -3 | 45 | 01 |

## APPARENT PLACES OF STARS, 2021

FOR $0^h$ TERRESTRIAL TIME

| Name | | α Scorpii A | | | | | | ζ Ophiuchi | | | | | | ε Scorpii | | | | | | θ Ophiuchi | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mag. Spect. | | 0.9 - 1.8 | | | M1.5 Iab-b | | | 2.56 | | | O9V | | | 2.29 | | | K1 III | | | 3.27 | | | B2 IV | | |
| U.T. | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | |
| | | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " |
| Jan. | 1 | 16 | 30 | 39 | -26 | 28 | 32 | 16 | 38 | 17 | -10 | 36 | 27 | 16 | 51 | 29 | -34 | 19 | 41 | 17 | 23 | 15 | -25 | 01 | 06 |
| | 11 | 16 | 30 | 40 | 26 | 28 | 32 | 16 | 38 | 17 | 10 | 36 | 29 | 16 | 51 | 29 | 34 | 19 | 41 | 17 | 23 | 16 | 25 | 01 | 06 |
| | 21 | 16 | 30 | 40 | 26 | 28 | 33 | 16 | 38 | 17 | 10 | 36 | 30 | 16 | 51 | 29 | 34 | 19 | 42 | 17 | 23 | 16 | 25 | 01 | 07 |
| | 31 | 16 | 30 | 40 | 26 | 28 | 34 | 16 | 38 | 18 | 10 | 36 | 31 | 16 | 51 | 30 | 34 | 19 | 42 | 17 | 23 | 16 | 25 | 01 | 07 |
| Feb. | 10 | 16 | 30 | 41 | 26 | 28 | 35 | 16 | 38 | 18 | 10 | 36 | 33 | 16 | 51 | 30 | 34 | 19 | 42 | 17 | 23 | 17 | 25 | 01 | 08 |
| | 20 | 16 | 30 | 41 | 26 | 28 | 36 | 16 | 38 | 18 | 10 | 36 | 34 | 16 | 51 | 31 | 34 | 19 | 43 | 17 | 23 | 17 | 25 | 01 | 08 |
| Mar. | 2 | 16 | 30 | 41 | -26 | 28 | 37 | 16 | 38 | 19 | -10 | 36 | 35 | 16 | 51 | 31 | -34 | 19 | 44 | 17 | 23 | 17 | -25 | 01 | 09 |
| | 12 | 16 | 30 | 42 | 26 | 28 | 38 | 16 | 38 | 19 | 10 | 36 | 35 | 16 | 51 | 31 | 34 | 19 | 44 | 17 | 23 | 18 | 25 | 01 | 09 |
| | 22 | 16 | 30 | 42 | 26 | 28 | 38 | 16 | 38 | 19 | 10 | 36 | 36 | 16 | 51 | 32 | 34 | 19 | 45 | 17 | 23 | 18 | 25 | 01 | 09 |
| Apr. | 1 | 16 | 30 | 42 | 26 | 28 | 39 | 16 | 38 | 19 | 10 | 36 | 36 | 16 | 51 | 32 | 34 | 19 | 46 | 17 | 23 | 18 | 25 | 01 | 10 |
| | 11 | 16 | 30 | 43 | 26 | 28 | 40 | 16 | 38 | 20 | 10 | 36 | 36 | 16 | 51 | 32 | 34 | 19 | 47 | 17 | 23 | 19 | 25 | 01 | 10 |
| | 21 | 16 | 30 | 43 | 26 | 28 | 40 | 16 | 38 | 20 | 10 | 36 | 36 | 16 | 51 | 33 | 34 | 19 | 48 | 17 | 23 | 19 | 25 | 01 | 10 |
| May | 1 | 16 | 30 | 43 | -26 | 28 | 41 | 16 | 38 | 20 | -10 | 36 | 36 | 16 | 51 | 33 | -34 | 19 | 48 | 17 | 23 | 19 | -25 | 01 | 10 |
| | 11 | 16 | 30 | 43 | 26 | 28 | 42 | 16 | 38 | 20 | 10 | 36 | 36 | 16 | 51 | 33 | 34 | 19 | 49 | 17 | 23 | 19 | 25 | 01 | 11 |
| | 21 | 16 | 30 | 44 | 26 | 28 | 42 | 16 | 38 | 21 | 10 | 36 | 35 | 16 | 51 | 33 | 34 | 19 | 50 | 17 | 23 | 20 | 25 | 01 | 11 |
| | 31 | 16 | 30 | 44 | 26 | 28 | 43 | 16 | 38 | 21 | 10 | 36 | 35 | 16 | 51 | 34 | 34 | 19 | 51 | 17 | 23 | 20 | 25 | 01 | 11 |
| June | 10 | 16 | 30 | 44 | 26 | 28 | 43 | 16 | 38 | 21 | 10 | 36 | 34 | 16 | 51 | 34 | 34 | 19 | 52 | 17 | 23 | 20 | 25 | 01 | 11 |
| | 20 | 16 | 30 | 44 | 26 | 28 | 44 | 16 | 38 | 21 | 10 | 36 | 34 | 16 | 51 | 34 | 34 | 19 | 53 | 17 | 23 | 20 | 25 | 01 | 12 |
| | 30 | 16 | 30 | 44 | -26 | 28 | 44 | 16 | 38 | 21 | -10 | 36 | 33 | 16 | 51 | 34 | -34 | 19 | 54 | 17 | 23 | 20 | -25 | 01 | 12 |
| July | 10 | 16 | 30 | 44 | 26 | 28 | 44 | 16 | 38 | 21 | 10 | 36 | 33 | 16 | 51 | 34 | 34 | 19 | 54 | 17 | 23 | 20 | 25 | 01 | 12 |
| | 20 | 16 | 30 | 44 | 26 | 28 | 45 | 16 | 38 | 21 | 10 | 36 | 32 | 16 | 51 | 34 | 34 | 19 | 55 | 17 | 23 | 20 | 25 | 01 | 12 |
| | 30 | 16 | 30 | 44 | 26 | 28 | 45 | 16 | 38 | 21 | 10 | 36 | 32 | 16 | 51 | 34 | 34 | 19 | 56 | 17 | 23 | 20 | 25 | 01 | 13 |
| Aug. | 9 | 16 | 30 | 44 | 26 | 28 | 45 | 16 | 38 | 21 | 10 | 36 | 32 | 16 | 51 | 34 | 34 | 19 | 56 | 17 | 23 | 20 | 25 | 01 | 13 |
| | 19 | 16 | 30 | 43 | 26 | 28 | 45 | 16 | 38 | 20 | 10 | 36 | 32 | 16 | 51 | 33 | 34 | 19 | 57 | 17 | 23 | 20 | 25 | 01 | 13 |
| | 29 | 16 | 30 | 43 | -26 | 28 | 45 | 16 | 38 | 20 | -10 | 36 | 31 | 16 | 51 | 33 | -34 | 19 | 57 | 17 | 23 | 20 | -25 | 01 | 13 |
| Sept. | 8 | 16 | 30 | 43 | 26 | 28 | 45 | 16 | 38 | 20 | 10 | 36 | 31 | 16 | 51 | 33 | 34 | 19 | 57 | 17 | 23 | 20 | 25 | 01 | 14 |
| | 18 | 16 | 30 | 43 | 26 | 28 | 45 | 16 | 38 | 20 | 10 | 36 | 31 | 16 | 51 | 33 | 34 | 19 | 57 | 17 | 23 | 19 | 25 | 01 | 13 |
| | 28 | 16 | 30 | 43 | 26 | 28 | 44 | 16 | 38 | 20 | 10 | 36 | 31 | 16 | 51 | 33 | 34 | 19 | 56 | 17 | 23 | 19 | 25 | 01 | 13 |
| Oct. | 8 | 16 | 30 | 43 | 26 | 28 | 44 | 16 | 38 | 20 | 10 | 36 | 31 | 16 | 51 | 32 | 34 | 19 | 56 | 17 | 23 | 19 | 25 | 01 | 13 |
| | 18 | 16 | 30 | 43 | 26 | 28 | 43 | 16 | 38 | 20 | 10 | 36 | 32 | 16 | 51 | 32 | 34 | 19 | 55 | 17 | 23 | 19 | 25 | 01 | 13 |
| | 28 | 16 | 30 | 42 | -26 | 28 | 43 | 16 | 38 | 20 | -10 | 36 | 32 | 16 | 51 | 32 | -34 | 19 | 54 | 17 | 23 | 19 | -25 | 01 | 13 |
| Nov. | 7 | 16 | 30 | 42 | 26 | 28 | 42 | 16 | 38 | 19 | 10 | 36 | 32 | 16 | 51 | 32 | 34 | 19 | 53 | 17 | 23 | 19 | 25 | 01 | 12 |
| | 17 | 16 | 30 | 42 | 26 | 28 | 42 | 16 | 38 | 20 | 10 | 36 | 33 | 16 | 51 | 32 | 34 | 19 | 53 | 17 | 23 | 19 | 25 | 01 | 12 |
| | 27 | 16 | 30 | 43 | 26 | 28 | 42 | 16 | 38 | 20 | 10 | 36 | 34 | 16 | 51 | 32 | 34 | 19 | 52 | 17 | 23 | 19 | 25 | 01 | 12 |
| Dec. | 7 | 16 | 30 | 43 | 26 | 28 | 42 | 16 | 38 | 20 | 10 | 36 | 34 | 16 | 51 | 32 | 34 | 19 | 51 | 17 | 23 | 19 | 25 | 01 | 12 |
| | 17 | 16 | 30 | 43 | 26 | 28 | 42 | 16 | 38 | 20 | 10 | 36 | 35 | 16 | 51 | 32 | 34 | 19 | 51 | 17 | 23 | 19 | 25 | 01 | 12 |
| | 27 | 16 | 30 | 43 | -26 | 28 | 42 | 16 | 38 | 20 | -10 | 36 | 37 | 16 | 51 | 33 | -34 | 19 | 51 | 17 | 23 | 19 | -25 | 01 | 12 |
| | 37 | 16 | 30 | 43 | -26 | 28 | 43 | 16 | 38 | 20 | -10 | 36 | 38 | 16 | 51 | 33 | -34 | 19 | 51 | 17 | 23 | 19 | -25 | 01 | 12 |

## APPARENT PLACES OF STARS, 2021

FOR $0^h$ TERRESTRIAL TIME

| Name | | λ Scorpii | | | | | | α Ophiuchi | | | | | | β Ophiuchi | | | | | | δ Sagittarii | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mag. Spect. | | 1.63 | | | B2 IV+ | | | 2.08 | | | A5 III | | | 2.77 | | | K2 III | | | 2.70 | | | K3IIIa | | |
| U.T. | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | |
| | | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " |
| Jan. | 1 | 17 | 34 | 59 | -37 | 07 | 00 | 17 | 35 | 52 | +12 | 32 | 43 | 17 | 44 | 28 | +4 | 33 | 33 | 18 | 22 | 17 | -29 | 49 | 04 |
| | 11 | 17 | 34 | 59 | 37 | 06 | 59 | 17 | 35 | 53 | 12 | 32 | 41 | 17 | 44 | 29 | 4 | 33 | 32 | 18 | 22 | 18 | 29 | 49 | 04 |
| | 21 | 17 | 35 | 00 | 37 | 06 | 59 | 17 | 35 | 53 | 12 | 32 | 38 | 17 | 44 | 29 | 4 | 33 | 30 | 18 | 22 | 18 | 29 | 49 | 04 |
| | 31 | 17 | 35 | 00 | 37 | 06 | 59 | 17 | 35 | 53 | 12 | 32 | 36 | 17 | 44 | 29 | 4 | 33 | 28 | 18 | 22 | 18 | 29 | 49 | 04 |
| Feb. | 10 | 17 | 35 | 00 | 37 | 06 | 59 | 17 | 35 | 53 | 12 | 32 | 35 | 17 | 44 | 29 | 4 | 33 | 27 | 18 | 22 | 18 | 29 | 49 | 03 |
| | 20 | 17 | 35 | 01 | 37 | 06 | 59 | 17 | 35 | 54 | 12 | 32 | 33 | 17 | 44 | 30 | 4 | 33 | 25 | 18 | 22 | 19 | 29 | 49 | 03 |
| Mar. | 2 | 17 | 35 | 01 | -37 | 06 | 59 | 17 | 35 | 54 | +12 | 32 | 32 | 17 | 44 | 30 | +4 | 33 | 24 | 18 | 22 | 19 | -29 | 49 | 03 |
| | 12 | 17 | 35 | 02 | 37 | 06 | 59 | 17 | 35 | 54 | 12 | 32 | 32 | 17 | 44 | 30 | 4 | 33 | 24 | 18 | 22 | 19 | 29 | 49 | 03 |
| | 22 | 17 | 35 | 02 | 37 | 06 | 59 | 17 | 35 | 54 | 12 | 32 | 32 | 17 | 44 | 30 | 4 | 33 | 24 | 18 | 22 | 20 | 29 | 49 | 03 |
| Apr. | 1 | 17 | 35 | 02 | 37 | 07 | 00 | 17 | 35 | 55 | 12 | 32 | 32 | 17 | 44 | 31 | 4 | 33 | 24 | 18 | 22 | 20 | 29 | 49 | 03 |
| | 11 | 17 | 35 | 03 | 37 | 07 | 00 | 17 | 35 | 55 | 12 | 32 | 32 | 17 | 44 | 31 | 4 | 33 | 24 | 18 | 22 | 20 | 29 | 49 | 03 |
| | 21 | 17 | 35 | 03 | 37 | 07 | 01 | 17 | 35 | 55 | 12 | 32 | 33 | 17 | 44 | 31 | 4 | 33 | 25 | 18 | 22 | 21 | 29 | 49 | 03 |
| May | 1 | 17 | 35 | 03 | -37 | 07 | 01 | 17 | 35 | 56 | +12 | 32 | 35 | 17 | 44 | 32 | +4 | 33 | 26 | 18 | 22 | 21 | -29 | 49 | 02 |
| | 11 | 17 | 35 | 04 | 37 | 07 | 02 | 17 | 35 | 56 | 12 | 32 | 36 | 17 | 44 | 32 | 4 | 33 | 27 | 18 | 22 | 21 | 29 | 49 | 03 |
| | 21 | 17 | 35 | 04 | 37 | 07 | 03 | 17 | 35 | 56 | 12 | 32 | 38 | 17 | 44 | 32 | 4 | 33 | 29 | 18 | 22 | 22 | 29 | 49 | 03 |
| | 31 | 17 | 35 | 04 | 37 | 07 | 04 | 17 | 35 | 56 | 12 | 32 | 40 | 17 | 44 | 32 | 4 | 33 | 30 | 18 | 22 | 22 | 29 | 49 | 03 |
| June | 10 | 17 | 35 | 04 | 37 | 07 | 05 | 17 | 35 | 56 | 12 | 32 | 42 | 17 | 44 | 32 | 4 | 33 | 32 | 18 | 22 | 22 | 29 | 49 | 03 |
| | 20 | 17 | 35 | 04 | 37 | 07 | 06 | 17 | 35 | 56 | 12 | 32 | 43 | 17 | 44 | 32 | 4 | 33 | 33 | 18 | 22 | 22 | 29 | 49 | 03 |
| | 30 | 17 | 35 | 05 | -37 | 07 | 07 | 17 | 35 | 56 | +12 | 32 | 45 | 17 | 44 | 33 | +4 | 33 | 35 | 18 | 22 | 23 | -29 | 49 | 04 |
| July | 10 | 17 | 35 | 05 | 37 | 07 | 07 | 17 | 35 | 56 | 12 | 32 | 47 | 17 | 44 | 33 | 4 | 33 | 36 | 18 | 22 | 23 | 29 | 49 | 04 |
| | 20 | 17 | 35 | 05 | 37 | 07 | 08 | 17 | 35 | 56 | 12 | 32 | 49 | 17 | 44 | 33 | 4 | 33 | 37 | 18 | 22 | 23 | 29 | 49 | 05 |
| | 30 | 17 | 35 | 05 | 37 | 07 | 09 | 17 | 35 | 56 | 12 | 32 | 50 | 17 | 44 | 32 | 4 | 33 | 38 | 18 | 22 | 23 | 29 | 49 | 05 |
| Aug. | 9 | 17 | 35 | 04 | 37 | 07 | 10 | 17 | 35 | 56 | 12 | 32 | 51 | 17 | 44 | 32 | 4 | 33 | 39 | 18 | 22 | 23 | 29 | 49 | 06 |
| | 19 | 17 | 35 | 04 | 37 | 07 | 11 | 17 | 35 | 56 | 12 | 32 | 52 | 17 | 44 | 32 | 4 | 33 | 40 | 18 | 22 | 23 | 29 | 49 | 06 |
| | 29 | 17 | 35 | 04 | -37 | 07 | 11 | 17 | 35 | 56 | +12 | 32 | 52 | 17 | 44 | 32 | +4 | 33 | 40 | 18 | 22 | 22 | -29 | 49 | 07 |
| Sept. | 8 | 17 | 35 | 04 | 37 | 07 | 12 | 17 | 35 | 56 | 12 | 32 | 53 | 17 | 44 | 32 | 4 | 33 | 41 | 18 | 22 | 22 | 29 | 49 | 08 |
| | 18 | 17 | 35 | 04 | 37 | 07 | 12 | 17 | 35 | 56 | 12 | 32 | 53 | 17 | 44 | 32 | 4 | 33 | 41 | 18 | 22 | 22 | 29 | 49 | 08 |
| | 28 | 17 | 35 | 04 | 37 | 07 | 11 | 17 | 35 | 55 | 12 | 32 | 53 | 17 | 44 | 32 | 4 | 33 | 41 | 18 | 22 | 22 | 29 | 49 | 08 |
| Oct. | 8 | 17 | 35 | 03 | 37 | 07 | 11 | 17 | 35 | 55 | 12 | 32 | 52 | 17 | 44 | 31 | 4 | 33 | 40 | 18 | 22 | 22 | 29 | 49 | 08 |
| | 18 | 17 | 35 | 03 | 37 | 07 | 11 | 17 | 35 | 55 | 12 | 32 | 51 | 17 | 44 | 31 | 4 | 33 | 40 | 18 | 22 | 22 | 29 | 49 | 08 |
| | 28 | 17 | 35 | 03 | -37 | 07 | 10 | 17 | 35 | 55 | +12 | 32 | 50 | 17 | 44 | 31 | +4 | 33 | 39 | 18 | 22 | 21 | -29 | 49 | 08 |
| Nov. | 7 | 17 | 35 | 03 | 37 | 07 | 09 | 17 | 35 | 55 | 12 | 32 | 49 | 17 | 44 | 31 | 4 | 33 | 38 | 18 | 22 | 21 | 29 | 49 | 07 |
| | 17 | 17 | 35 | 03 | 37 | 07 | 09 | 17 | 35 | 55 | 12 | 32 | 47 | 17 | 44 | 31 | 4 | 33 | 37 | 18 | 22 | 21 | 29 | 49 | 07 |
| | 27 | 17 | 35 | 03 | 37 | 07 | 08 | 17 | 35 | 55 | 12 | 32 | 45 | 17 | 44 | 31 | 4 | 33 | 35 | 18 | 22 | 21 | 29 | 49 | 07 |
| Dec. | 7 | 17 | 35 | 03 | 37 | 07 | 07 | 17 | 35 | 55 | 12 | 32 | 44 | 17 | 44 | 31 | 4 | 33 | 34 | 18 | 22 | 21 | 29 | 49 | 06 |
| | 17 | 17 | 35 | 03 | 37 | 07 | 06 | 17 | 35 | 55 | 12 | 32 | 41 | 17 | 44 | 31 | 4 | 33 | 32 | 18 | 22 | 21 | 29 | 49 | 06 |
| | 27 | 17 | 35 | 03 | -37 | 07 | 05 | 17 | 35 | 55 | +12 | 32 | 39 | 17 | 44 | 31 | +4 | 33 | 30 | 18 | 22 | 21 | -29 | 49 | 06 |
| | 37 | 17 | 35 | 04 | -37 | 07 | 05 | 17 | 35 | 55 | +12 | 32 | 37 | 17 | 44 | 32 | +4 | 33 | 28 | 18 | 22 | 22 | -29 | 49 | 05 |

## APPARENT PLACES OF STARS, 2021

FOR $0^h$ TERRESTRIAL TIME

| Name | | ε Sagittarii | | | | | | σ Sagittarii | | | | | | ζ Aquilae | | | | | | γ Aquilae | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mag. Spect. | | 1.85 | | | B9.5III | | | 2.02 | | | B2V | | | 2.99 | | | A0 Vn | | | 2.72 | | | G9.5IV | | |
| U.T. | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | |
| | | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " |
| Jan. | 1 | 18 | 25 | 31 | -34 | 22 | 24 | 18 | 56 | 31 | -26 | 16 | 13 | 19 | 06 | 20 | +13 | 53 | 42 | 19 | 47 | 13 | +10 | 39 | 52 |
| | 11 | 18 | 25 | 31 | 34 | 22 | 24 | 18 | 56 | 31 | 26 | 16 | 12 | 19 | 06 | 20 | 13 | 53 | 40 | 19 | 47 | 13 | 10 | 39 | 50 |
| | 21 | 18 | 25 | 31 | 34 | 22 | 23 | 18 | 56 | 32 | 26 | 16 | 12 | 19 | 06 | 20 | 13 | 53 | 37 | 19 | 47 | 13 | 10 | 39 | 48 |
| | 31 | 18 | 25 | 32 | 34 | 22 | 23 | 18 | 56 | 32 | 26 | 16 | 12 | 19 | 06 | 21 | 13 | 53 | 36 | 19 | 47 | 13 | 10 | 39 | 47 |
| Feb. | 10 | 18 | 25 | 32 | 34 | 22 | 22 | 18 | 56 | 32 | 26 | 16 | 12 | 19 | 06 | 21 | 13 | 53 | 34 | 19 | 47 | 14 | 10 | 39 | 45 |
| | 20 | 18 | 25 | 32 | 34 | 22 | 22 | 18 | 56 | 32 | 26 | 16 | 11 | 19 | 06 | 21 | 13 | 53 | 32 | 19 | 47 | 14 | 10 | 39 | 44 |
| Mar. | 2 | 18 | 25 | 33 | -34 | 22 | 22 | 18 | 56 | 33 | -26 | 16 | 11 | 19 | 06 | 21 | +13 | 53 | 31 | 19 | 47 | 14 | +10 | 39 | 43 |
| | 12 | 18 | 25 | 33 | 34 | 22 | 21 | 18 | 56 | 33 | 26 | 16 | 11 | 19 | 06 | 22 | 13 | 53 | 30 | 19 | 47 | 14 | 10 | 39 | 42 |
| | 22 | 18 | 25 | 33 | 34 | 22 | 21 | 18 | 56 | 33 | 26 | 16 | 10 | 19 | 06 | 22 | 13 | 53 | 30 | 19 | 47 | 15 | 10 | 39 | 42 |
| Apr. | 1 | 18 | 25 | 34 | 34 | 22 | 21 | 18 | 56 | 34 | 26 | 16 | 10 | 19 | 06 | 22 | 13 | 53 | 30 | 19 | 47 | 15 | 10 | 39 | 42 |
| | 11 | 18 | 25 | 34 | 34 | 22 | 21 | 18 | 56 | 34 | 26 | 16 | 10 | 19 | 06 | 22 | 13 | 53 | 30 | 19 | 47 | 15 | 10 | 39 | 42 |
| | 21 | 18 | 25 | 34 | 34 | 22 | 21 | 18 | 56 | 34 | 26 | 16 | 09 | 19 | 06 | 23 | 13 | 53 | 32 | 19 | 47 | 15 | 10 | 39 | 43 |
| May | 1 | 18 | 25 | 35 | -34 | 22 | 21 | 18 | 56 | 35 | -26 | 16 | 08 | 19 | 06 | 23 | +13 | 53 | 33 | 19 | 47 | 16 | +10 | 39 | 45 |
| | 11 | 18 | 25 | 35 | 34 | 22 | 21 | 18 | 56 | 35 | 26 | 16 | 08 | 19 | 06 | 23 | 13 | 53 | 34 | 19 | 47 | 16 | 10 | 39 | 46 |
| | 21 | 18 | 25 | 35 | 34 | 22 | 21 | 18 | 56 | 35 | 26 | 16 | 08 | 19 | 06 | 24 | 13 | 53 | 36 | 19 | 47 | 16 | 10 | 39 | 48 |
| | 31 | 18 | 25 | 36 | 34 | 22 | 22 | 18 | 56 | 36 | 26 | 16 | 07 | 19 | 06 | 24 | 13 | 53 | 38 | 19 | 47 | 17 | 10 | 39 | 50 |
| June | 10 | 18 | 25 | 36 | 34 | 22 | 22 | 18 | 56 | 36 | 26 | 16 | 07 | 19 | 06 | 24 | 13 | 53 | 40 | 19 | 47 | 17 | 10 | 39 | 52 |
| | 20 | 18 | 25 | 36 | 34 | 22 | 23 | 18 | 56 | 36 | 26 | 16 | 07 | 19 | 06 | 24 | 13 | 53 | 42 | 19 | 47 | 17 | 10 | 39 | 54 |
| | 30 | 18 | 25 | 36 | -34 | 22 | 23 | 18 | 56 | 36 | -26 | 16 | 07 | 19 | 06 | 24 | +13 | 53 | 45 | 19 | 47 | 17 | +10 | 39 | 56 |
| July | 10 | 18 | 25 | 36 | 34 | 22 | 24 | 18 | 56 | 36 | 26 | 16 | 07 | 19 | 06 | 24 | 13 | 53 | 47 | 19 | 47 | 17 | 10 | 39 | 58 |
| | 20 | 18 | 25 | 36 | 34 | 22 | 25 | 18 | 56 | 36 | 26 | 16 | 08 | 19 | 06 | 25 | 13 | 53 | 49 | 19 | 47 | 18 | 10 | 40 | 00 |
| | 30 | 18 | 25 | 36 | 34 | 22 | 26 | 18 | 56 | 36 | 26 | 16 | 08 | 19 | 06 | 25 | 13 | 53 | 50 | 19 | 47 | 18 | 10 | 40 | 01 |
| Aug. | 9 | 18 | 25 | 36 | 34 | 22 | 27 | 18 | 56 | 36 | 26 | 16 | 09 | 19 | 06 | 25 | 13 | 53 | 52 | 19 | 47 | 18 | 10 | 40 | 03 |
| | 19 | 18 | 25 | 36 | 34 | 22 | 27 | 18 | 56 | 36 | 26 | 16 | 09 | 19 | 06 | 24 | 13 | 53 | 53 | 19 | 47 | 18 | 10 | 40 | 05 |
| | 29 | 18 | 25 | 36 | -34 | 22 | 28 | 18 | 56 | 36 | -26 | 16 | 10 | 19 | 06 | 24 | +13 | 53 | 54 | 19 | 47 | 17 | +10 | 40 | 06 |
| Sept. | 8 | 18 | 25 | 36 | 34 | 22 | 29 | 18 | 56 | 36 | 26 | 16 | 10 | 19 | 06 | 24 | 13 | 53 | 55 | 19 | 47 | 17 | 10 | 40 | 07 |
| | 18 | 18 | 25 | 36 | 34 | 22 | 29 | 18 | 56 | 36 | 26 | 16 | 11 | 19 | 06 | 24 | 13 | 53 | 56 | 19 | 47 | 17 | 10 | 40 | 07 |
| | 28 | 18 | 25 | 36 | 34 | 22 | 29 | 18 | 56 | 36 | 26 | 16 | 11 | 19 | 06 | 24 | 13 | 53 | 56 | 19 | 47 | 17 | 10 | 40 | 08 |
| Oct. | 8 | 18 | 25 | 35 | 34 | 22 | 29 | 18 | 56 | 36 | 26 | 16 | 11 | 19 | 06 | 24 | 13 | 53 | 56 | 19 | 47 | 17 | 10 | 40 | 08 |
| | 18 | 18 | 25 | 35 | 34 | 22 | 29 | 18 | 56 | 35 | 26 | 16 | 12 | 19 | 06 | 24 | 13 | 53 | 56 | 19 | 47 | 17 | 10 | 40 | 08 |
| | 28 | 18 | 25 | 35 | -34 | 22 | 29 | 18 | 56 | 35 | -26 | 16 | 11 | 19 | 06 | 23 | +13 | 53 | 55 | 19 | 47 | 17 | +10 | 40 | 07 |
| Nov. | 7 | 18 | 25 | 35 | 34 | 22 | 28 | 18 | 56 | 35 | 26 | 16 | 11 | 19 | 06 | 23 | 13 | 53 | 54 | 19 | 47 | 16 | 10 | 40 | 07 |
| | 17 | 18 | 25 | 35 | 34 | 22 | 28 | 18 | 56 | 35 | 26 | 16 | 11 | 19 | 06 | 23 | 13 | 53 | 53 | 19 | 47 | 16 | 10 | 40 | 06 |
| | 27 | 18 | 25 | 35 | 34 | 22 | 27 | 18 | 56 | 35 | 26 | 16 | 11 | 19 | 06 | 23 | 13 | 53 | 52 | 19 | 47 | 16 | 10 | 40 | 05 |
| Dec. | 7 | 18 | 25 | 35 | 34 | 22 | 27 | 18 | 56 | 35 | 26 | 16 | 11 | 19 | 06 | 23 | 13 | 53 | 50 | 19 | 47 | 16 | 10 | 40 | 03 |
| | 17 | 18 | 25 | 35 | 34 | 22 | 26 | 18 | 56 | 35 | 26 | 16 | 11 | 19 | 06 | 23 | 13 | 53 | 48 | 19 | 47 | 16 | 10 | 40 | 02 |
| | 27 | 18 | 25 | 35 | -34 | 22 | 25 | 18 | 56 | 35 | -26 | 16 | 11 | 19 | 06 | 23 | +13 | 53 | 46 | 19 | 47 | 16 | +10 | 40 | 00 |
| | 37 | 18 | 25 | 35 | -34 | 22 | 25 | 18 | 56 | 35 | -26 | 16 | 10 | 19 | 06 | 23 | +13 | 53 | 44 | 19 | 47 | 16 | +10 | 39 | 58 |

## APPARENT PLACES OF STARS, 2021

FOR $0^h$ TERRESTRIAL TIME

| Name | | α Aquilae | | | | | | γ Cygni | | | | | | α Cygni | | | | | | β Aquarii | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mag. Spect. | | 0.77 | | | A7 V | | | 2.20 | | | F8 I ab | | | 1.25 | | | A2 Iae | | | 2.91 | | | A1.5V | | |
| U.T. | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | |
| | | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " |
| Jan. | 1 | 19 | 51 | 46 | +8 | 55 | 26 | 20 | 22 | 57 | +40 | 19 | 29 | 20 | 42 | 06 | +45 | 21 | 24 | 21 | 32 | 38 | -5 | 28 | 49 |
| | 11 | 19 | 51 | 46 | 8 | 55 | 24 | 20 | 22 | 57 | 40 | 19 | 26 | 20 | 42 | 06 | 45 | 21 | 21 | 21 | 32 | 38 | 5 | 28 | 50 |
| | 21 | 19 | 51 | 46 | 8 | 55 | 22 | 20 | 22 | 57 | 40 | 19 | 23 | 20 | 42 | 06 | 45 | 21 | 18 | 21 | 32 | 38 | 5 | 28 | 50 |
| | 31 | 19 | 51 | 46 | 8 | 55 | 21 | 20 | 22 | 57 | 40 | 19 | 20 | 20 | 42 | 06 | 45 | 21 | 15 | 21 | 32 | 38 | 5 | 28 | 51 |
| Feb. | 10 | 19 | 51 | 47 | 8 | 55 | 19 | 20 | 22 | 57 | 40 | 19 | 18 | 20 | 42 | 07 | 45 | 21 | 12 | 21 | 32 | 38 | 5 | 28 | 51 |
| | 20 | 19 | 51 | 47 | 8 | 55 | 18 | 20 | 22 | 57 | 40 | 19 | 15 | 20 | 42 | 07 | 45 | 21 | 09 | 21 | 32 | 38 | 5 | 28 | 51 |
| Mar. | 2 | 19 | 51 | 47 | +8 | 55 | 17 | 20 | 22 | 57 | +40 | 19 | 12 | 20 | 42 | 07 | +45 | 21 | 06 | 21 | 32 | 38 | -5 | 28 | 51 |
| | 12 | 19 | 51 | 47 | 8 | 55 | 16 | 20 | 22 | 57 | 40 | 19 | 11 | 20 | 42 | 07 | 45 | 21 | 04 | 21 | 32 | 38 | 5 | 28 | 51 |
| | 22 | 19 | 51 | 48 | 8 | 55 | 16 | 20 | 22 | 58 | 40 | 19 | 09 | 20 | 42 | 07 | 45 | 21 | 03 | 21 | 32 | 38 | 5 | 28 | 51 |
| Apr. | 1 | 19 | 51 | 48 | 8 | 55 | 16 | 20 | 22 | 58 | 40 | 19 | 09 | 20 | 42 | 08 | 45 | 21 | 01 | 21 | 32 | 39 | 5 | 28 | 50 |
| | 11 | 19 | 51 | 48 | 8 | 55 | 17 | 20 | 22 | 58 | 40 | 19 | 08 | 20 | 42 | 08 | 45 | 21 | 01 | 21 | 32 | 39 | 5 | 28 | 49 |
| | 21 | 19 | 51 | 48 | 8 | 55 | 18 | 20 | 22 | 59 | 40 | 19 | 09 | 20 | 42 | 08 | 45 | 21 | 01 | 21 | 32 | 39 | 5 | 28 | 48 |
| May | 1 | 19 | 51 | 49 | +8 | 55 | 19 | 20 | 22 | 59 | +40 | 19 | 10 | 20 | 42 | 09 | +45 | 21 | 02 | 21 | 32 | 39 | -5 | 28 | 46 |
| | 11 | 19 | 51 | 49 | 8 | 55 | 20 | 20 | 22 | 59 | 40 | 19 | 11 | 20 | 42 | 09 | 45 | 21 | 03 | 21 | 32 | 40 | 5 | 28 | 45 |
| | 21 | 19 | 51 | 49 | 8 | 55 | 22 | 20 | 23 | 00 | 40 | 19 | 13 | 20 | 42 | 10 | 45 | 21 | 05 | 21 | 32 | 40 | 5 | 28 | 43 |
| | 31 | 19 | 51 | 50 | 8 | 55 | 24 | 20 | 23 | 00 | 40 | 19 | 15 | 20 | 42 | 10 | 45 | 21 | 07 | 21 | 32 | 40 | 5 | 28 | 41 |
| June | 10 | 19 | 51 | 50 | 8 | 55 | 26 | 20 | 23 | 00 | 40 | 19 | 18 | 20 | 42 | 10 | 45 | 21 | 10 | 21 | 32 | 41 | 5 | 28 | 40 |
| | 20 | 19 | 51 | 50 | 8 | 55 | 28 | 20 | 23 | 01 | 40 | 19 | 21 | 20 | 42 | 11 | 45 | 21 | 12 | 21 | 32 | 41 | 5 | 28 | 38 |
| | 30 | 19 | 51 | 50 | +8 | 55 | 30 | 20 | 23 | 01 | +40 | 19 | 24 | 20 | 42 | 11 | +45 | 21 | 16 | 21 | 32 | 41 | -5 | 28 | 36 |
| July | 10 | 19 | 51 | 50 | 8 | 55 | 32 | 20 | 23 | 01 | 40 | 19 | 27 | 20 | 42 | 11 | 45 | 21 | 19 | 21 | 32 | 42 | 5 | 28 | 35 |
| | 20 | 19 | 51 | 51 | 8 | 55 | 34 | 20 | 23 | 01 | 40 | 19 | 30 | 20 | 42 | 11 | 45 | 21 | 22 | 21 | 32 | 42 | 5 | 28 | 33 |
| | 30 | 19 | 51 | 51 | 8 | 55 | 36 | 20 | 23 | 01 | 40 | 19 | 33 | 20 | 42 | 11 | 45 | 21 | 25 | 21 | 32 | 42 | 5 | 28 | 32 |
| Aug. | 9 | 19 | 51 | 51 | 8 | 55 | 37 | 20 | 23 | 01 | 40 | 19 | 37 | 20 | 42 | 11 | 45 | 21 | 29 | 21 | 32 | 42 | 5 | 28 | 31 |
| | 19 | 19 | 51 | 51 | 8 | 55 | 39 | 20 | 23 | 01 | 40 | 19 | 39 | 20 | 42 | 11 | 45 | 21 | 32 | 21 | 32 | 42 | 5 | 28 | 30 |
| | 29 | 19 | 51 | 51 | +8 | 55 | 40 | 20 | 23 | 01 | +40 | 19 | 42 | 20 | 42 | 11 | +45 | 21 | 35 | 21 | 32 | 42 | -5 | 28 | 30 |
| Sept. | 8 | 19 | 51 | 50 | 8 | 55 | 40 | 20 | 23 | 01 | 40 | 19 | 44 | 20 | 42 | 11 | 45 | 21 | 37 | 21 | 32 | 42 | 5 | 28 | 29 |
| | 18 | 19 | 51 | 50 | 8 | 55 | 41 | 20 | 23 | 01 | 40 | 19 | 46 | 20 | 42 | 11 | 45 | 21 | 39 | 21 | 32 | 42 | 5 | 28 | 29 |
| | 28 | 19 | 51 | 50 | 8 | 55 | 42 | 20 | 23 | 01 | 40 | 19 | 47 | 20 | 42 | 11 | 45 | 21 | 41 | 21 | 32 | 42 | 5 | 28 | 29 |
| Oct. | 8 | 19 | 51 | 50 | 8 | 55 | 41 | 20 | 23 | 00 | 40 | 19 | 48 | 20 | 42 | 10 | 45 | 21 | 42 | 21 | 32 | 42 | 5 | 28 | 29 |
| | 18 | 19 | 51 | 50 | 8 | 55 | 41 | 20 | 23 | 00 | 40 | 19 | 49 | 20 | 42 | 10 | 45 | 21 | 43 | 21 | 32 | 42 | 5 | 28 | 30 |
| | 28 | 19 | 51 | 50 | +8 | 55 | 41 | 20 | 23 | 00 | +40 | 19 | 49 | 20 | 42 | 10 | +45 | 21 | 44 | 21 | 32 | 42 | -5 | 28 | 30 |
| Nov. | 7 | 19 | 51 | 49 | 8 | 55 | 40 | 20 | 23 | 00 | 40 | 19 | 49 | 20 | 42 | 10 | 45 | 21 | 44 | 21 | 32 | 42 | 5 | 28 | 31 |
| | 17 | 19 | 51 | 49 | 8 | 55 | 39 | 20 | 22 | 59 | 40 | 19 | 48 | 20 | 42 | 09 | 45 | 21 | 43 | 21 | 32 | 41 | 5 | 28 | 31 |
| | 27 | 19 | 51 | 49 | 8 | 55 | 39 | 20 | 22 | 59 | 40 | 19 | 47 | 20 | 42 | 09 | 45 | 21 | 42 | 21 | 32 | 41 | 5 | 28 | 32 |
| Dec. | 7 | 19 | 51 | 49 | 8 | 55 | 37 | 20 | 22 | 59 | 40 | 19 | 45 | 20 | 42 | 09 | 45 | 21 | 41 | 21 | 32 | 41 | 5 | 28 | 32 |
| | 17 | 19 | 51 | 49 | 8 | 55 | 36 | 20 | 22 | 59 | 40 | 19 | 43 | 20 | 42 | 09 | 45 | 21 | 39 | 21 | 32 | 41 | 5 | 28 | 33 |
| | 27 | 19 | 51 | 49 | +8 | 55 | 34 | 20 | 22 | 59 | +40 | 19 | 40 | 20 | 42 | 09 | +45 | 21 | 36 | 21 | 32 | 41 | -5 | 28 | 34 |
| | 37 | 19 | 51 | 49 | +8 | 55 | 33 | 20 | 22 | 59 | +40 | 19 | 38 | 20 | 42 | 08 | +45 | 21 | 34 | 21 | 32 | 41 | -5 | 28 | 34 |

## APPARENT PLACES OF STARS, 2021

FOR $0^h$ TERRESTRIAL TIME

| Name | | ε Pegasi | | | | | | α Aquarii | | | | | | δ Aquarii | | | | | | α Pegasi | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mag. Spect. | | 0.7 - 3.5 | | | K2 Ib | | | 2.96 | | | G2 Ib | | | 3.27 | | | A3 V | | | 2.49 | | | B9III | | |
| U.T. | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | |
| | | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " |
| Jan. | 1 | 21 | 45 | 11 | +9 | 58 | 15 | 22 | 06 | 50 | -0 | 13 | 09 | 22 | 55 | 44 | -15 | 42 | 44 | 23 | 05 | 47 | +15 | 19 | 04 |
| | 11 | 21 | 45 | 11 | 9 | 58 | 13 | 22 | 06 | 50 | 0 | 13 | 10 | 22 | 55 | 44 | 15 | 42 | 45 | 23 | 05 | 47 | 15 | 19 | 03 |
| | 21 | 21 | 45 | 11 | 9 | 58 | 12 | 22 | 06 | 50 | 0 | 13 | 11 | 22 | 55 | 44 | 15 | 42 | 45 | 23 | 05 | 47 | 15 | 19 | 01 |
| | 31 | 21 | 45 | 11 | 9 | 58 | 11 | 22 | 06 | 50 | 0 | 13 | 12 | 22 | 55 | 44 | 15 | 42 | 44 | 23 | 05 | 47 | 15 | 19 | 00 |
| Feb. | 10 | 21 | 45 | 11 | 9 | 58 | 09 | 22 | 06 | 50 | 0 | 13 | 12 | 22 | 55 | 44 | 15 | 42 | 44 | 23 | 05 | 47 | 15 | 18 | 59 |
| | 20 | 21 | 45 | 11 | 9 | 58 | 08 | 22 | 06 | 50 | 0 | 13 | 13 | 22 | 55 | 44 | 15 | 42 | 44 | 23 | 05 | 47 | 15 | 18 | 58 |
| Mar. | 2 | 21 | 45 | 11 | +9 | 58 | 07 | 22 | 06 | 50 | -0 | 13 | 13 | 22 | 55 | 44 | -15 | 42 | 43 | 23 | 05 | 47 | +15 | 18 | 57 |
| | 12 | 21 | 45 | 11 | 9 | 58 | 07 | 22 | 06 | 50 | 0 | 13 | 13 | 22 | 55 | 44 | 15 | 42 | 42 | 23 | 05 | 47 | 15 | 18 | 56 |
| | 22 | 21 | 45 | 12 | 9 | 58 | 06 | 22 | 06 | 50 | 0 | 13 | 13 | 22 | 55 | 44 | 15 | 42 | 41 | 23 | 05 | 47 | 15 | 18 | 55 |
| Apr. | 1 | 21 | 45 | 12 | 9 | 58 | 06 | 22 | 06 | 50 | 0 | 13 | 13 | 22 | 55 | 44 | 15 | 42 | 39 | 23 | 05 | 47 | 15 | 18 | 55 |
| | 11 | 21 | 45 | 12 | 9 | 58 | 07 | 22 | 06 | 51 | 0 | 13 | 12 | 22 | 55 | 45 | 15 | 42 | 38 | 23 | 05 | 47 | 15 | 18 | 55 |
| | 21 | 21 | 45 | 12 | 9 | 58 | 07 | 22 | 06 | 51 | 0 | 13 | 11 | 22 | 55 | 45 | 15 | 42 | 36 | 23 | 05 | 47 | 15 | 18 | 55 |
| May | 1 | 21 | 45 | 13 | +9 | 58 | 09 | 22 | 06 | 51 | -0 | 13 | 09 | 22 | 55 | 45 | -15 | 42 | 34 | 23 | 05 | 48 | +15 | 18 | 56 |
| | 11 | 21 | 45 | 13 | 9 | 58 | 10 | 22 | 06 | 52 | 0 | 13 | 08 | 22 | 55 | 45 | 15 | 42 | 32 | 23 | 05 | 48 | 15 | 18 | 57 |
| | 21 | 21 | 45 | 13 | 9 | 58 | 11 | 22 | 06 | 52 | 0 | 13 | 06 | 22 | 55 | 46 | 15 | 42 | 30 | 23 | 05 | 48 | 15 | 18 | 58 |
| | 31 | 21 | 45 | 14 | 9 | 58 | 13 | 22 | 06 | 52 | 0 | 13 | 04 | 22 | 55 | 46 | 15 | 42 | 28 | 23 | 05 | 49 | 15 | 19 | 00 |
| June | 10 | 21 | 45 | 14 | 9 | 58 | 15 | 22 | 06 | 52 | 0 | 13 | 02 | 22 | 55 | 46 | 15 | 42 | 26 | 23 | 05 | 49 | 15 | 19 | 02 |
| | 20 | 21 | 45 | 14 | 9 | 58 | 17 | 22 | 06 | 53 | 0 | 13 | 00 | 22 | 55 | 47 | 15 | 42 | 24 | 23 | 05 | 49 | 15 | 19 | 04 |
| | 30 | 21 | 45 | 14 | +9 | 58 | 20 | 22 | 06 | 53 | -0 | 12 | 58 | 22 | 55 | 47 | -15 | 42 | 22 | 23 | 05 | 50 | +15 | 19 | 06 |
| July | 10 | 21 | 45 | 15 | 9 | 58 | 22 | 22 | 06 | 53 | 0 | 12 | 56 | 22 | 55 | 47 | 15 | 42 | 21 | 23 | 05 | 50 | 15 | 19 | 08 |
| | 20 | 21 | 45 | 15 | 9 | 58 | 24 | 22 | 06 | 54 | 0 | 12 | 55 | 22 | 55 | 47 | 15 | 42 | 20 | 23 | 05 | 50 | 15 | 19 | 11 |
| | 30 | 21 | 45 | 15 | 9 | 58 | 26 | 22 | 06 | 54 | 0 | 12 | 53 | 22 | 55 | 48 | 15 | 42 | 19 | 23 | 05 | 50 | 15 | 19 | 13 |
| Aug. | 9 | 21 | 45 | 15 | 9 | 58 | 28 | 22 | 06 | 54 | 0 | 12 | 52 | 22 | 55 | 48 | 15 | 42 | 18 | 23 | 05 | 51 | 15 | 19 | 15 |
| | 19 | 21 | 45 | 15 | 9 | 58 | 30 | 22 | 06 | 54 | 0 | 12 | 51 | 22 | 55 | 48 | 15 | 42 | 18 | 23 | 05 | 51 | 15 | 19 | 17 |
| | 29 | 21 | 45 | 15 | +9 | 58 | 31 | 22 | 06 | 54 | -0 | 12 | 50 | 22 | 55 | 48 | -15 | 42 | 18 | 23 | 05 | 51 | +15 | 19 | 19 |
| Sept. | 8 | 21 | 45 | 15 | 9 | 58 | 32 | 22 | 06 | 54 | 0 | 12 | 49 | 22 | 55 | 48 | 15 | 42 | 18 | 23 | 05 | 51 | 15 | 19 | 21 |
| | 18 | 21 | 45 | 15 | 9 | 58 | 34 | 22 | 06 | 54 | 0 | 12 | 48 | 22 | 55 | 48 | 15 | 42 | 18 | 23 | 05 | 51 | 15 | 19 | 23 |
| | 28 | 21 | 45 | 15 | 9 | 58 | 34 | 22 | 06 | 54 | 0 | 12 | 48 | 22 | 55 | 48 | 15 | 42 | 19 | 23 | 05 | 51 | 15 | 19 | 24 |
| Oct. | 8 | 21 | 45 | 15 | 9 | 58 | 35 | 22 | 06 | 54 | 0 | 12 | 48 | 22 | 55 | 48 | 15 | 42 | 19 | 23 | 05 | 51 | 15 | 19 | 25 |
| | 18 | 21 | 45 | 15 | 9 | 58 | 35 | 22 | 06 | 54 | 0 | 12 | 48 | 22 | 55 | 48 | 15 | 42 | 20 | 23 | 05 | 51 | 15 | 19 | 25 |
| | 28 | 21 | 45 | 15 | +9 | 58 | 35 | 22 | 06 | 54 | -0 | 12 | 48 | 22 | 55 | 48 | -15 | 42 | 21 | 23 | 05 | 51 | +15 | 19 | 26 |
| Nov. | 7 | 21 | 45 | 15 | 9 | 58 | 35 | 22 | 06 | 54 | 0 | 12 | 49 | 22 | 55 | 48 | 15 | 42 | 22 | 23 | 05 | 51 | 15 | 19 | 26 |
| | 17 | 21 | 45 | 15 | 9 | 58 | 35 | 22 | 06 | 53 | 0 | 12 | 49 | 22 | 55 | 48 | 15 | 42 | 23 | 23 | 05 | 51 | 15 | 19 | 26 |
| | 27 | 21 | 45 | 14 | 9 | 58 | 34 | 22 | 06 | 53 | 0 | 12 | 50 | 22 | 55 | 48 | 15 | 42 | 23 | 23 | 05 | 50 | 15 | 19 | 26 |
| Dec. | 7 | 21 | 45 | 14 | 9 | 58 | 33 | 22 | 06 | 53 | 0 | 12 | 50 | 22 | 55 | 48 | 15 | 42 | 24 | 23 | 05 | 50 | 15 | 19 | 26 |
| | 17 | 21 | 45 | 14 | 9 | 58 | 32 | 22 | 06 | 53 | 0 | 12 | 51 | 22 | 55 | 48 | 15 | 42 | 25 | 23 | 05 | 50 | 15 | 19 | 25 |
| | 27 | 21 | 45 | 14 | +9 | 58 | 31 | 22 | 06 | 53 | -0 | 12 | 52 | 22 | 55 | 47 | -15 | 42 | 25 | 23 | 05 | 50 | +15 | 19 | 24 |
| | 37 | 21 | 45 | 14 | +9 | 58 | 30 | 22 | 06 | 53 | -0 | 12 | 53 | 22 | 55 | 47 | -15 | 42 | 25 | 23 | 05 | 50 | +15 | 19 | 23 |

**BESSELIAN DAY NUMBERS, 2021.5**

FOR $0^h$ TERRESTRIAL TIME

| Date | | τ | A | B | C | D | E | dψ | dε |
|---|---|---|---|---|---|---|---|---|---|
| | | | " | " | " | " | s (0.0001) | | |
| Jan. | 0 | -0.5021 | -16.539 | -1.213 | -3.269 | +20.532 | -21 | +0.070 | -0.093 |
| | 1 | 0.4993 | 16.435 | 1.259 | 3.597 | 20.467 | 21 | 0.145 | 0.063 |
| | 2 | 0.4966 | 16.345 | 1.319 | 3.924 | 20.397 | 21 | 0.182 | 0.020 |
| | 3 | 0.4938 | 16.275 | 1.384 | 4.249 | 20.321 | 21 | 0.172 | +0.029 |
| | 4 | 0.4911 | 16.224 | 1.445 | 4.574 | 20.239 | 21 | 0.113 | 0.072 |
| | 5 | 0.4884 | 16.188 | 1.491 | 4.898 | 20.150 | 21 | +0.017 | 0.099 |
| | 6 | -0.4856 | -16.159 | -1.514 | -5.221 | +20.055 | -21 | -0.094 | +0.103 |
| | 7 | 0.4829 | 16.126 | 1.513 | 5.542 | 19.955 | 21 | 0.194 | 0.083 |
| | 8 | 0.4802 | 16.077 | 1.492 | 5.863 | 19.847 | 21 | 0.254 | +0.041 |
| | 9 | 0.4774 | 16.006 | 1.460 | 6.181 | 19.733 | 21 | 0.255 | -0.011 |
| | 10 | 0.4747 | 15.909 | 1.432 | 6.498 | 19.613 | 21 | 0.194 | 0.061 |
| | 11 | 0.4719 | 15.793 | 1.419 | 6.814 | 19.486 | 21 | -0.082 | 0.096 |
| | 12 | -0.4692 | -15.668 | -1.430 | -7.127 | +19.352 | -20 | +0.053 | -0.107 |
| | 13 | 0.4665 | 15.548 | 1.469 | 7.437 | 19.212 | 20 | 0.180 | 0.092 |
| | 14 | 0.4637 | 15.442 | 1.529 | 7.746 | 19.066 | 20 | 0.270 | 0.056 |
| | 15 | 0.4610 | 15.358 | 1.600 | 8.051 | 18.913 | 20 | 0.306 | -0.008 |
| | 16 | 0.4582 | 15.297 | 1.672 | 8.354 | 18.754 | 20 | 0.286 | +0.039 |
| | 17 | 0.4555 | 15.255 | 1.734 | 8.653 | 18.590 | 20 | 0.219 | 0.077 |
| | 18 | -0.4528 | -15.226 | -1.781 | -8.949 | +18.419 | -20 | +0.122 | +0.098 |
| | 19 | 0.4500 | 15.202 | 1.811 | 9.242 | 18.243 | 20 | +0.013 | 0.102 |
| | 20 | 0.4473 | 15.176 | 1.823 | 9.532 | 18.061 | 20 | -0.090 | 0.088 |
| | 21 | 0.4446 | 15.143 | 1.821 | 9.819 | 17.873 | 20 | 0.173 | 0.060 |
| | 22 | 0.4418 | 15.097 | 1.809 | 10.102 | 17.681 | 20 | 0.223 | +0.021 |
| | 23 | 0.4391 | 15.037 | 1.794 | 10.382 | 17.483 | 20 | 0.236 | -0.021 |
| | 24 | -0.4363 | -14.962 | -1.782 | -10.658 | +17.280 | -20 | -0.208 | -0.061 |
| | 25 | 0.4336 | 14.873 | 1.780 | 10.931 | 17.072 | 20 | 0.145 | 0.090 |
| | 26 | 0.4309 | 14.775 | 1.793 | 11.200 | 16.860 | 20 | -0.056 | 0.105 |
| | 27 | 0.4281 | 14.673 | 1.826 | 11.465 | 16.642 | 20 | +0.042 | 0.100 |
| | 28 | 0.4254 | 14.577 | 1.880 | 11.727 | 16.420 | 20 | 0.128 | 0.075 |
| | 29 | 0.4227 | 14.494 | 1.949 | 11.986 | 16.194 | 20 | 0.183 | -0.033 |
| | 30 | -0.4199 | -14.431 | -2.027 | -12.241 | +15.963 | -20 | +0.190 | +0.016 |
| | 31 | 0.4172 | 14.389 | 2.103 | 12.492 | 15.727 | 20 | 0.146 | 0.064 |
| Feb. | 1 | 0.4144 | 14.365 | 2.165 | 12.740 | 15.487 | 20 | +0.057 | 0.097 |
| | 2 | 0.4117 | 14.350 | 2.204 | 12.984 | 15.242 | 20 | -0.053 | 0.107 |
| | 3 | 0.4090 | 14.334 | 2.217 | 13.225 | 14.992 | 20 | 0.158 | 0.092 |
| | 4 | 0.4062 | 14.305 | 2.208 | 13.462 | 14.738 | 20 | 0.228 | 0.054 |
| | 5 | -0.4035 | -14.255 | -2.186 | -13.695 | +14.479 | -20 | -0.245 | +0.003 |
| | 6 | 0.4008 | 14.182 | 2.164 | 13.924 | 14.215 | 20 | 0.202 | -0.048 |
| | 7 | 0.3980 | 14.090 | 2.153 | 14.148 | 13.947 | 20 | -0.107 | 0.087 |
| | 8 | 0.3953 | 13.986 | 2.164 | 14.368 | 13.674 | 20 | +0.016 | 0.105 |
| | 9 | 0.3925 | 13.883 | 2.199 | 14.584 | 13.396 | 20 | 0.141 | 0.098 |
| | 10 | 0.3898 | 13.790 | 2.256 | 14.795 | 13.114 | 19 | 0.240 | 0.069 |
| | 11 | -0.3871 | -13.716 | -2.328 | -15.001 | +12.828 | -19 | +0.293 | -0.025 |
| | 12 | 0.3843 | 13.665 | 2.403 | 15.202 | 12.538 | 19 | 0.292 | +0.023 |
| | 13 | 0.3816 | 13.634 | 2.473 | 15.398 | 12.243 | 19 | 0.240 | 0.065 |
| | 14 | 0.3789 | 13.619 | 2.528 | 15.588 | 11.945 | 20 | 0.152 | 0.093 |
| | 15 | -0.3761 | -13.612 | -2.566 | -15.774 | +11.644 | -20 | +0.044 | +0.103 |

**BESSELIAN DAY NUMBERS, 2021.5**

FOR $0^h$ TERRESTRIAL TIME

| Date | | τ | A | B | C | D | E | dψ | dε |
|---|---|---|---|---|---|---|---|---|---|
| | | | " | " | " | " | s (0.0001) | | |
| Feb. | 15 | -0.3761 | -13.612 | -2.566 | -15.774 | +11.644 | -20 | +0.044 | +0.103 |
| | 16 | 0.3734 | 13.605 | 2.584 | 15.954 | 11.339 | 20 | 0.064 | +0.095 |
| | 17 | 0.3706 | 13.592 | 2.586 | 16.128 | 11.031 | 20 | 0.155 | 0.070 |
| | 18 | 0.3679 | 13.569 | 2.576 | 16.298 | 10.719 | 20 | 0.217 | +0.035 |
| | 19 | 0.3652 | 13.531 | 2.560 | 16.462 | 10.406 | 20 | 0.242 | -0.007 |
| | 20 | 0.3624 | 13.479 | 2.544 | 16.620 | 10.089 | 20 | 0.228 | 0.048 |
| | 21 | -0.3597 | -13.412 | -2.535 | -16.774 | +9.770 | -20 | -0.178 | -0.082 |
| | 22 | 0.3569 | 13.335 | 2.539 | 16.921 | 9.448 | 20 | 0.099 | 0.102 |
| | 23 | 0.3542 | 13.251 | 2.561 | 17.064 | 9.124 | 20 | -0.004 | 0.105 |
| | 24 | 0.3515 | 13.170 | 2.602 | 17.202 | 8.798 | 20 | +0.089 | 0.087 |
| | 25 | 0.3487 | 13.097 | 2.661 | 17.334 | 8.470 | 20 | 0.159 | 0.051 |
| | 26 | 0.3460 | 13.042 | 2.733 | 17.461 | 8.140 | 20 | 0.188 | -0.002 |
| | 27 | -0.3433 | -13.008 | -2.806 | -17.583 | +7.808 | -20 | +0.164 | +0.049 |
| | 28 | 0.3405 | 12.994 | 2.868 | 17.700 | 7.474 | 20 | +0.089 | 0.090 |
| Mar. | 1 | 0.3378 | 12.994 | 2.908 | 17.812 | 7.139 | 20 | -0.018 | 0.109 |
| | 2 | 0.3350 | 12.996 | 2.920 | 17.919 | 6.801 | 20 | 0.128 | 0.101 |
| | 3 | 0.3323 | 12.986 | 2.906 | 18.021 | 6.461 | 21 | 0.210 | 0.068 |
| | 4 | 0.3296 | 12.956 | 2.875 | 18.117 | 6.120 | 21 | 0.238 | +0.018 |
| | 5 | -0.3268 | -12.901 | -2.840 | -18.209 | +5.776 | -21 | -0.205 | -0.036 |
| | 6 | 0.3241 | 12.826 | 2.815 | 18.295 | 5.431 | 21 | -0.118 | 0.079 |
| | 7 | 0.3214 | 12.737 | 2.809 | 18.375 | 5.083 | 21 | +0.001 | 0.102 |
| | 8 | 0.3186 | 12.648 | 2.827 | 18.450 | 4.734 | 20 | 0.126 | 0.101 |
| | 9 | 0.3159 | 12.566 | 2.867 | 18.520 | 4.383 | 20 | 0.229 | 0.077 |
| | 10 | 0.3131 | 12.502 | 2.922 | 18.583 | 4.031 | 20 | 0.291 | -0.037 |
| | 11 | -0.3104 | -12.458 | -2.983 | -18.640 | +3.678 | -20 | +0.302 | +0.010 |
| | 12 | 0.3077 | 12.434 | 3.041 | 18.691 | 3.323 | 20 | 0.263 | 0.054 |
| | 13 | 0.3049 | 12.426 | 3.087 | 18.737 | 2.968 | 21 | 0.183 | 0.086 |
| | 14 | 0.3022 | 12.429 | 3.116 | 18.776 | 2.612 | 21 | +0.079 | 0.102 |
| | 15 | 0.2995 | 12.434 | 3.125 | 18.809 | 2.255 | 21 | -0.032 | 0.100 |
| | 16 | 0.2967 | 12.434 | 3.116 | 18.836 | 1.898 | 21 | 0.130 | 0.080 |
| | 17 | -0.2940 | -12.424 | -3.094 | -18.857 | +1.541 | -21 | -0.203 | +0.047 |
| | 18 | 0.2912 | 12.400 | 3.063 | 18.873 | 1.185 | 21 | 0.241 | +0.006 |
| | 19 | 0.2885 | 12.361 | 3.030 | 18.882 | 0.828 | 21 | 0.240 | -0.036 |
| | 20 | 0.2858 | 12.308 | 3.002 | 18.885 | 0.472 | 21 | 0.202 | 0.072 |
| | 21 | 0.2830 | 12.242 | 2.985 | 18.883 | +0.116 | 21 | 0.134 | 0.097 |
| | 22 | 0.2803 | 12.168 | 2.983 | 18.875 | -0.239 | 21 | -0.047 | 0.106 |
| | 23 | -0.2775 | -12.093 | -2.999 | -18.862 | -0.594 | -21 | +0.044 | -0.096 |
| | 24 | 0.2748 | 12.024 | 3.033 | 18.843 | 0.947 | 21 | 0.121 | 0.067 |
| | 25 | 0.2721 | 11.967 | 3.083 | 18.818 | 1.300 | 21 | 0.165 | -0.023 |
| | 26 | 0.2693 | 11.929 | 3.138 | 18.788 | 1.651 | 21 | 0.163 | +0.028 |
| | 27 | 0.2666 | 11.912 | 3.189 | 18.753 | 2.001 | 21 | 0.109 | 0.076 |
| | 28 | 0.2639 | 11.911 | 3.223 | 18.713 | 2.351 | 22 | +0.012 | 0.106 |
| | 29 | -0.2611 | -11.917 | -3.229 | -18.668 | -2.699 | -22 | -0.103 | +0.110 |
| | 30 | 0.2584 | 11.916 | 3.205 | 18.618 | 3.046 | 22 | 0.200 | 0.084 |
| | 31 | 0.2556 | 11.895 | 3.158 | 18.563 | 3.392 | 22 | 0.247 | +0.036 |
| Apr. | 1 | 0.2529 | 11.847 | 3.102 | 18.502 | 3.737 | 22 | 0.228 | -0.020 |
| | 2 | -0.2502 | -11.774 | -3.052 | -18.437 | -4.082 | -22 | -0.146 | -0.070 |

**BESSELIAN DAY NUMBERS, 2021.5**

FOR $0^h$ TERRESTRIAL TIME

| Date | | τ | A | B | C | D | E | dψ | dε |
|---|---|---|---|---|---|---|---|---|---|
| | | | " | " | " | " | s (0.0001) | | |
| Apr. | 1 | -0.2529 | -11.847 | -3.102 | -18.502 | -3.737 | -22 | -0.228 | -0.020 |
| | 2 | 0.2502 | 11.774 | 3.052 | 18.437 | 4.082 | 22 | 0.146 | 0.070 |
| | 3 | 0.2474 | 11.684 | 3.021 | 18.366 | 4.425 | 22 | -0.023 | 0.100 |
| | 4 | 0.2447 | 11.590 | 3.015 | 18.290 | 4.767 | 22 | +0.110 | 0.104 |
| | 5 | 0.2420 | 11.504 | 3.033 | 18.208 | 5.108 | 22 | 0.225 | 0.084 |
| | 6 | 0.2392 | 11.433 | 3.068 | 18.121 | 5.448 | 22 | 0.299 | -0.047 |
| | 7 | -0.2365 | -11.382 | -3.112 | -18.028 | -5.786 | -22 | +0.321 | +0.000 |
| | 8 | 0.2337 | 11.351 | 3.153 | 17.930 | 6.122 | 22 | 0.292 | 0.045 |
| | 9 | 0.2310 | 11.337 | 3.185 | 17.826 | 6.457 | 22 | 0.219 | 0.081 |
| | 10 | 0.2283 | 11.334 | 3.200 | 17.717 | 6.789 | 22 | 0.119 | 0.101 |
| | 11 | 0.2255 | 11.335 | 3.197 | 17.602 | 7.119 | 22 | +0.007 | 0.103 |
| | 12 | 0.2228 | 11.333 | 3.176 | 17.482 | 7.446 | 22 | -0.097 | 0.088 |
| | 13 | -0.2201 | -11.321 | -3.140 | -17.356 | -7.771 | -23 | -0.179 | +0.058 |
| | 14 | 0.2173 | 11.296 | 3.094 | 17.226 | 8.093 | 23 | 0.228 | +0.019 |
| | 15 | 0.2146 | 11.255 | 3.045 | 17.090 | 8.412 | 23 | 0.239 | -0.024 |
| | 16 | 0.2118 | 11.199 | 2.999 | 16.949 | 8.729 | 23 | 0.213 | 0.062 |
| | 17 | 0.2091 | 11.129 | 2.962 | 16.803 | 9.042 | 23 | 0.154 | 0.091 |
| | 18 | 0.2064 | 11.050 | 2.940 | 16.652 | 9.352 | 23 | -0.074 | 0.105 |
| | 19 | -0.2036 | -10.969 | -2.936 | -16.496 | -9.658 | -22 | +0.013 | -0.101 |
| | 20 | 0.2009 | 10.890 | 2.949 | 16.336 | 9.961 | 22 | 0.090 | 0.079 |
| | 21 | 0.1982 | 10.821 | 2.977 | 16.171 | 10.260 | 22 | 0.142 | -0.041 |
| | 22 | 0.1954 | 10.768 | 3.016 | 16.002 | 10.556 | 22 | 0.154 | +0.007 |
| | 23 | 0.1927 | 10.733 | 3.056 | 15.829 | 10.848 | 22 | 0.119 | 0.056 |
| | 24 | 0.1899 | 10.715 | 3.084 | 15.652 | 11.137 | 23 | +0.037 | 0.094 |
| | 25 | -0.1872 | -10.709 | -3.090 | -15.470 | -11.422 | -23 | -0.075 | +0.111 |
| | 26 | 0.1845 | 10.702 | 3.067 | 15.285 | 11.703 | 23 | 0.185 | 0.098 |
| | 27 | 0.1817 | 10.680 | 3.016 | 15.096 | 11.981 | 23 | 0.258 | 0.058 |
| | 28 | 0.1790 | 10.631 | 2.949 | 14.904 | 12.255 | 23 | 0.266 | +0.001 |
| | 29 | 0.1762 | 10.552 | 2.881 | 14.707 | 12.527 | 23 | 0.201 | -0.056 |
| | 30 | 0.1735 | 10.450 | 2.830 | 14.507 | 12.794 | 23 | -0.080 | 0.096 |
| May | 1 | -0.1708 | -10.339 | -2.806 | -14.302 | -13.059 | -23 | +0.066 | -0.109 |
| | 2 | 0.1680 | 10.231 | 2.809 | 14.094 | 13.320 | 22 | 0.201 | 0.095 |
| | 3 | 0.1653 | 10.138 | 2.833 | 13.881 | 13.578 | 22 | 0.296 | 0.059 |
| | 4 | 0.1626 | 10.066 | 2.869 | 13.664 | 13.831 | 22 | 0.336 | -0.012 |
| | 5 | 0.1598 | 10.016 | 2.905 | 13.443 | 14.081 | 22 | 0.320 | +0.035 |
| | 6 | 0.1571 | 9.985 | 2.933 | 13.218 | 14.327 | 22 | 0.257 | 0.075 |
| | 7 | -0.1543 | -9.966 | -2.947 | -12.989 | -14.569 | -22 | +0.161 | +0.099 |
| | 8 | 0.1516 | 9.952 | 2.943 | 12.756 | 14.806 | 23 | +0.050 | 0.106 |
| | 9 | 0.1489 | 9.936 | 2.920 | 12.520 | 15.038 | 23 | -0.058 | 0.095 |
| | 10 | 0.1461 | 9.913 | 2.882 | 12.279 | 15.267 | 23 | 0.148 | 0.068 |
| | 11 | 0.1434 | 9.876 | 2.834 | 12.035 | 15.490 | 23 | 0.207 | +0.030 |
| | 12 | 0.1407 | 9.825 | 2.781 | 11.787 | 15.708 | 23 | 0.228 | -0.012 |
| | 13 | -0.1379 | -9.757 | -2.731 | -11.536 | -15.922 | -23 | -0.211 | -0.052 |
| | 14 | 0.1352 | 9.676 | 2.688 | 11.282 | 16.130 | 23 | 0.161 | 0.084 |
| | 15 | 0.1324 | 9.584 | 2.660 | 11.024 | 16.334 | 23 | 0.087 | 0.102 |
| | 16 | 0.1297 | 9.488 | 2.649 | 10.764 | 16.532 | 22 | -0.002 | 0.103 |
| | 17 | -0.1270 | -9.394 | -2.656 | -10.501 | -16.725 | -22 | +0.077 | -0.086 |

**BESSELIAN DAY NUMBERS, 2021.5**

FOR $0^h$ TERRESTRIAL TIME

| Date | | τ | A | B | C | D | E | dψ | dε |
|---|---|---|---|---|---|---|---|---|---|
| | | | " | " | " | " | s (0.0001) | | |
| May | 17 | -0.1270 | -9.394 | -2.656 | -10.501 | -16.725 | -22 | +0.077 | -0.086 |
| | 18 | 0.1242 | 9.308 | 2.680 | 10.235 | 16.913 | 22 | 0.133 | 0.053 |
| | 19 | 0.1215 | 9.236 | 2.715 | 9.966 | 17.095 | 22 | 0.153 | -0.009 |
| | 20 | 0.1188 | 9.181 | 2.754 | 9.695 | 17.272 | 22 | 0.129 | +0.038 |
| | 21 | 0.1160 | 9.143 | 2.786 | 9.422 | 17.444 | 22 | +0.060 | 0.080 |
| | 22 | 0.1133 | 9.119 | 2.803 | 9.146 | 17.611 | 22 | -0.043 | 0.104 |
| | 23 | -0.1105 | -9.098 | -2.795 | -8.869 | -17.772 | -22 | -0.157 | +0.104 |
| | 24 | 0.1078 | 9.069 | 2.759 | 8.589 | 17.928 | 23 | 0.252 | 0.075 |
| | 25 | 0.1051 | 9.019 | 2.701 | 8.308 | 18.079 | 23 | 0.293 | +0.025 |
| | 26 | 0.1023 | 8.939 | 2.635 | 8.025 | 18.226 | 22 | 0.261 | -0.034 |
| | 27 | 0.0996 | 8.830 | 2.579 | 7.741 | 18.367 | 22 | 0.159 | 0.084 |
| | 28 | 0.0969 | 8.704 | 2.546 | 7.454 | 18.504 | 22 | -0.012 | 0.111 |
| | 29 | -0.0941 | -8.574 | -2.545 | -7.165 | -18.637 | -22 | +0.141 | -0.107 |
| | 30 | 0.0914 | 8.456 | 2.570 | 6.874 | 18.764 | 22 | 0.264 | 0.077 |
| | 31 | 0.0886 | 8.360 | 2.613 | 6.582 | 18.886 | 21 | 0.332 | -0.030 |
| June | 1 | 0.0859 | 8.288 | 2.660 | 6.287 | 19.004 | 21 | 0.338 | +0.021 |
| | 2 | 0.0832 | 8.237 | 2.701 | 5.990 | 19.116 | 21 | 0.289 | 0.066 |
| | 3 | 0.0804 | 8.202 | 2.728 | 5.691 | 19.222 | 22 | 0.200 | 0.096 |
| | 4 | -0.0777 | -8.175 | -2.738 | -5.390 | -19.324 | -22 | +0.091 | +0.108 |
| | 5 | 0.0749 | 8.148 | 2.729 | 5.087 | 19.419 | 22 | -0.020 | 0.101 |
| | 6 | 0.0722 | 8.115 | 2.705 | 4.783 | 19.509 | 22 | 0.115 | 0.077 |
| | 7 | 0.0695 | 8.070 | 2.668 | 4.478 | 19.593 | 22 | 0.183 | +0.042 |
| | 8 | 0.0667 | 8.010 | 2.626 | 4.171 | 19.672 | 22 | 0.214 | 0.000 |
| | 9 | 0.0640 | 7.935 | 2.585 | 3.862 | 19.744 | 22 | 0.206 | -0.041 |
| | 10 | -0.0613 | -7.846 | -2.552 | -3.553 | -19.811 | -22 | -0.163 | -0.076 |
| | 11 | 0.0585 | 7.746 | 2.532 | 3.242 | 19.872 | 21 | 0.093 | 0.098 |
| | 12 | 0.0558 | 7.640 | 2.528 | 2.931 | 19.926 | 21 | -0.009 | 0.103 |
| | 13 | 0.0530 | 7.534 | 2.543 | 2.619 | 19.975 | 21 | +0.072 | 0.091 |
| | 14 | 0.0503 | 7.437 | 2.576 | 2.307 | 20.017 | 21 | 0.135 | 0.061 |
| | 15 | 0.0476 | 7.352 | 2.621 | 1.994 | 20.054 | 21 | 0.163 | -0.020 |
| | 16 | -0.0448 | -7.285 | -2.672 | -1.681 | -20.085 | -21 | +0.148 | +0.026 |
| | 17 | 0.0421 | 7.235 | 2.720 | 1.368 | 20.109 | 21 | +0.089 | 0.069 |
| | 18 | 0.0394 | 7.200 | 2.754 | 1.055 | 20.128 | 21 | -0.007 | 0.097 |
| | 19 | 0.0366 | 7.172 | 2.768 | 0.742 | 20.141 | 21 | 0.121 | 0.104 |
| | 20 | 0.0339 | 7.140 | 2.756 | 0.429 | 20.148 | 21 | 0.225 | 0.086 |
| | 21 | 0.0311 | 7.093 | 2.722 | -0.117 | 20.150 | 21 | 0.291 | +0.044 |
| | 22 | -0.0284 | -7.021 | -2.675 | +0.195 | -20.146 | -21 | -0.294 | -0.012 |
| | 23 | 0.0257 | 6.920 | 2.629 | 0.506 | 20.137 | 21 | 0.225 | 0.067 |
| | 24 | 0.0229 | 6.796 | 2.600 | 0.817 | 20.123 | 21 | -0.097 | 0.105 |
| | 25 | 0.0202 | 6.660 | 2.600 | 1.127 | 20.104 | 20 | +0.059 | 0.115 |
| | 26 | 0.0175 | 6.530 | 2.631 | 1.438 | 20.080 | 20 | 0.203 | 0.095 |
| | 27 | 0.0147 | 6.418 | 2.685 | 1.748 | 20.051 | 20 | 0.300 | -0.052 |
| | 28 | -0.0120 | -6.331 | -2.750 | +2.058 | -20.016 | -20 | +0.335 | +0.001 |
| | 29 | 0.0092 | 6.269 | 2.813 | 2.367 | 19.976 | 21 | 0.308 | 0.051 |
| | 30 | 0.0065 | 6.227 | 2.864 | 2.677 | 19.931 | 21 | 0.232 | 0.088 |
| July | 1 | 0.0038 | 6.196 | 2.896 | 2.986 | 19.880 | 21 | 0.127 | 0.107 |
| | 2 | -0.0010 | -6.168 | -2.909 | +3.294 | -19.823 | -21 | +0.015 | +0.106 |

**BESSELIAN DAY NUMBERS, 2021.5**

FOR $0^h$ TERRESTRIAL TIME

| Date | | τ | A | B | C | D | E | dψ | dε |
|---|---|---|---|---|---|---|---|---|---|
| | | | " | " | " | " | s (0.0001) | | |
| July | 1 | -0.0038 | -6.196 | -2.896 | +2.986 | -19.880 | -21 | +0.127 | +0.107 |
| | 2 | -0.0010 | 6.168 | 2.909 | 3.294 | 19.823 | 21 | +0.015 | 0.106 |
| | 3 | +0.0017 | 6.136 | 2.905 | 3.602 | 19.761 | 21 | -0.086 | 0.087 |
| | 4 | 0.0044 | 6.095 | 2.888 | 3.909 | 19.693 | 21 | 0.162 | 0.054 |
| | 5 | 0.0072 | 6.039 | 2.863 | 4.215 | 19.619 | 20 | 0.202 | +0.013 |
| | 6 | 0.0099 | 5.968 | 2.837 | 4.521 | 19.539 | 20 | 0.204 | -0.030 |
| | 7 | +0.0127 | -5.883 | -2.817 | +4.825 | -19.454 | -20 | -0.169 | -0.067 |
| | 8 | 0.0154 | 5.786 | 2.809 | 5.128 | 19.362 | 20 | 0.104 | 0.093 |
| | 9 | 0.0181 | 5.683 | 2.817 | 5.429 | 19.265 | 20 | -0.020 | 0.103 |
| | 10 | 0.0209 | 5.578 | 2.844 | 5.729 | 19.162 | 20 | +0.065 | 0.095 |
| | 11 | 0.0236 | 5.481 | 2.889 | 6.028 | 19.053 | 19 | 0.135 | 0.069 |
| | 12 | 0.0264 | 5.396 | 2.948 | 6.324 | 18.939 | 19 | 0.174 | -0.030 |
| | 13 | +0.0291 | -5.328 | -3.015 | +6.618 | -18.819 | -19 | +0.170 | +0.017 |
| | 14 | 0.0318 | 5.279 | 3.079 | 6.911 | 18.693 | 19 | 0.121 | 0.061 |
| | 15 | 0.0346 | 5.246 | 3.133 | 7.201 | 18.562 | 19 | +0.032 | 0.093 |
| | 16 | 0.0373 | 5.222 | 3.166 | 7.488 | 18.425 | 19 | -0.080 | 0.105 |
| | 17 | 0.0400 | 5.198 | 3.176 | 7.774 | 18.283 | 20 | 0.190 | 0.093 |
| | 18 | 0.0428 | 5.163 | 3.163 | 8.056 | 18.137 | 20 | 0.269 | 0.057 |
| | 19 | +0.0455 | -5.106 | -3.134 | +8.336 | -17.985 | -20 | -0.295 | +0.006 |
| | 20 | 0.0483 | 5.024 | 3.102 | 8.613 | 17.828 | 20 | 0.255 | -0.049 |
| | 21 | 0.0510 | 4.918 | 3.082 | 8.888 | 17.667 | 19 | 0.154 | 0.093 |
| | 22 | 0.0537 | 4.796 | 3.085 | 9.160 | 17.502 | 19 | -0.012 | 0.114 |
| | 23 | 0.0565 | 4.673 | 3.116 | 9.430 | 17.332 | 19 | +0.135 | 0.106 |
| | 24 | 0.0592 | 4.562 | 3.175 | 9.697 | 17.157 | 19 | 0.252 | 0.072 |
| | 25 | +0.0619 | -4.473 | -3.250 | +9.962 | -16.979 | -19 | +0.315 | -0.022 |
| | 26 | 0.0647 | 4.410 | 3.329 | 10.224 | 16.795 | 19 | 0.313 | +0.032 |
| | 27 | 0.0674 | 4.371 | 3.398 | 10.485 | 16.607 | 19 | 0.254 | 0.076 |
| | 28 | 0.0702 | 4.347 | 3.451 | 10.742 | 16.415 | 19 | 0.158 | 0.103 |
| | 29 | 0.0729 | 4.330 | 3.482 | 10.997 | 16.217 | 19 | +0.046 | 0.109 |
| | 30 | 0.0756 | 4.311 | 3.494 | 11.249 | 16.015 | 19 | -0.061 | 0.095 |
| | 31 | +0.0784 | -4.283 | -3.490 | +11.499 | -15.808 | -19 | -0.145 | +0.065 |
| Aug. | 1 | 0.0811 | 4.244 | 3.477 | 11.746 | 15.597 | 19 | 0.196 | +0.026 |
| | 2 | 0.0838 | 4.189 | 3.460 | 11.989 | 15.380 | 19 | 0.209 | -0.018 |
| | 3 | 0.0866 | 4.120 | 3.446 | 12.230 | 15.159 | 19 | 0.183 | 0.057 |
| | 4 | 0.0893 | 4.038 | 3.443 | 12.467 | 14.934 | 19 | 0.124 | 0.087 |
| | 5 | 0.0921 | 3.948 | 3.454 | 12.701 | 14.703 | 19 | -0.044 | 0.102 |
| | 6 | +0.0948 | -3.855 | -3.484 | +12.931 | -14.468 | -19 | +0.045 | -0.099 |
| | 7 | 0.0975 | 3.767 | 3.532 | 13.158 | 14.228 | 19 | 0.123 | 0.078 |
| | 8 | 0.1003 | 3.690 | 3.596 | 13.381 | 13.984 | 19 | 0.175 | -0.041 |
| | 9 | 0.1030 | 3.630 | 3.669 | 13.600 | 13.735 | 19 | 0.186 | +0.006 |
| | 10 | 0.1057 | 3.590 | 3.742 | 13.815 | 13.482 | 19 | 0.149 | 0.052 |
| | 11 | 0.1085 | 3.567 | 3.805 | 14.026 | 13.225 | 19 | +0.069 | 0.089 |
| | 12 | +0.1112 | -3.556 | -3.849 | +14.232 | -12.964 | -19 | -0.040 | +0.106 |
| | 13 | 0.1140 | 3.547 | 3.869 | 14.434 | 12.699 | 19 | 0.152 | 0.100 |
| | 14 | 0.1167 | 3.530 | 3.864 | 14.632 | 12.430 | 19 | 0.241 | 0.069 |
| | 15 | 0.1194 | 3.493 | 3.842 | 14.825 | 12.158 | 19 | 0.281 | +0.020 |
| | 16 | +0.1222 | -3.433 | -3.813 | +15.014 | -11.883 | -19 | -0.259 | -0.034 |

**BESSELIAN DAY NUMBERS, 2021.5**

FOR $0^h$ TERRESTRIAL TIME

| Date | | τ | A | B | C | D | E | dψ | dε |
|---|---|---|---|---|---|---|---|---|---|
| | | | " | " | " | " | s (0.0001) | | |
| Aug. | 16 | +0.1222 | -3.433 | -3.813 | +15.014 | -11.883 | -19 | -0.259 | -0.034 |
| | 17 | 0.1249 | 3.349 | 3.792 | 15.198 | 11.604 | 19 | 0.177 | 0.081 |
| | 18 | 0.1277 | 3.248 | 3.790 | 15.378 | 11.323 | 19 | -0.052 | 0.109 |
| | 19 | 0.1304 | 3.142 | 3.814 | 15.554 | 11.038 | 19 | +0.088 | 0.110 |
| | 20 | 0.1331 | 3.044 | 3.864 | 15.725 | 10.751 | 19 | 0.212 | 0.085 |
| | 21 | 0.1359 | 2.963 | 3.933 | 15.892 | 10.461 | 18 | 0.290 | -0.040 |
| | 22 | +0.1386 | -2.907 | -4.011 | +16.056 | -10.168 | -18 | +0.310 | +0.013 |
| | 23 | 0.1413 | 2.874 | 4.084 | 16.215 | 9.873 | 19 | 0.270 | 0.061 |
| | 24 | 0.1441 | 2.861 | 4.142 | 16.370 | 9.574 | 19 | 0.185 | 0.096 |
| | 25 | 0.1468 | 2.857 | 4.179 | 16.520 | 9.273 | 19 | +0.075 | 0.109 |
| | 26 | 0.1496 | 2.854 | 4.195 | 16.667 | 8.969 | 19 | -0.036 | 0.102 |
| | 27 | 0.1523 | 2.845 | 4.193 | 16.809 | 8.662 | 19 | 0.129 | 0.077 |
| | 28 | +0.1550 | -2.824 | -4.177 | +16.946 | -8.352 | -19 | -0.191 | +0.039 |
| | 29 | 0.1578 | 2.789 | 4.156 | 17.080 | 8.039 | 19 | 0.216 | -0.004 |
| | 30 | 0.1605 | 2.738 | 4.136 | 17.208 | 7.723 | 19 | 0.201 | 0.046 |
| | 31 | 0.1632 | 2.674 | 4.123 | 17.332 | 7.405 | 19 | 0.152 | 0.080 |
| Sept. | 1 | 0.1660 | 2.600 | 4.123 | 17.451 | 7.083 | 19 | -0.077 | 0.100 |
| | 2 | 0.1687 | 2.521 | 4.140 | 17.565 | 6.760 | 19 | +0.010 | 0.103 |
| | 3 | +0.1715 | -2.444 | -4.176 | +17.674 | -6.433 | -19 | +0.094 | -0.088 |
| | 4 | 0.1742 | 2.376 | 4.228 | 17.778 | 6.104 | 19 | 0.158 | 0.055 |
| | 5 | 0.1769 | 2.323 | 4.291 | 17.876 | 5.773 | 19 | 0.185 | -0.010 |
| | 6 | 0.1797 | 2.288 | 4.358 | 17.969 | 5.440 | 19 | 0.166 | +0.039 |
| | 7 | 0.1824 | 2.273 | 4.418 | 18.057 | 5.104 | 19 | +0.099 | 0.081 |
| | 8 | 0.1851 | 2.272 | 4.460 | 18.139 | 4.767 | 19 | -0.004 | 0.106 |
| | 9 | +0.1879 | -2.276 | -4.477 | +18.216 | -4.427 | -20 | -0.119 | +0.107 |
| | 10 | 0.1906 | 2.274 | 4.468 | 18.287 | 4.087 | 20 | 0.216 | 0.081 |
| | 11 | 0.1934 | 2.253 | 4.437 | 18.352 | 3.745 | 20 | 0.269 | +0.035 |
| | 12 | 0.1961 | 2.209 | 4.396 | 18.411 | 3.402 | 20 | 0.259 | -0.020 |
| | 13 | 0.1988 | 2.140 | 4.360 | 18.465 | 3.058 | 20 | 0.188 | 0.071 |
| | 14 | 0.2016 | 2.053 | 4.341 | 18.514 | 2.714 | 20 | -0.070 | 0.103 |
| | 15 | +0.2043 | -1.958 | -4.346 | +18.557 | -2.369 | -20 | +0.066 | -0.111 |
| | 16 | 0.2070 | 1.868 | 4.377 | 18.595 | 2.024 | 20 | 0.192 | 0.092 |
| | 17 | 0.2098 | 1.794 | 4.428 | 18.627 | 1.678 | 20 | 0.279 | 0.053 |
| | 18 | 0.2125 | 1.741 | 4.490 | 18.655 | 1.332 | 20 | 0.312 | -0.002 |
| | 19 | 0.2153 | 1.711 | 4.550 | 18.677 | 0.985 | 20 | 0.287 | +0.048 |
| | 20 | 0.2180 | 1.700 | 4.599 | 18.695 | 0.638 | 20 | 0.214 | 0.087 |
| | 21 | +0.2207 | -1.702 | -4.628 | +18.707 | -0.291 | -20 | +0.109 | +0.107 |
| | 22 | 0.2235 | 1.708 | 4.636 | 18.714 | +0.057 | 20 | -0.005 | 0.107 |
| | 23 | 0.2262 | 1.709 | 4.624 | 18.717 | 0.405 | 20 | 0.107 | 0.087 |
| | 24 | 0.2290 | 1.699 | 4.596 | 18.714 | 0.754 | 20 | 0.181 | 0.053 |
| | 25 | 0.2317 | 1.674 | 4.560 | 18.705 | 1.103 | 21 | 0.218 | +0.010 |
| | 26 | 0.2344 | 1.633 | 4.523 | 18.692 | 1.452 | 21 | 0.216 | -0.033 |
| | 27 | +0.2372 | -1.578 | -4.490 | +18.673 | +1.801 | -21 | -0.177 | -0.070 |
| | 28 | 0.2399 | 1.512 | 4.469 | 18.649 | 2.150 | 21 | 0.110 | 0.096 |
| | 29 | 0.2426 | 1.439 | 4.464 | 18.619 | 2.500 | 21 | -0.027 | 0.105 |
| | 30 | 0.2454 | 1.365 | 4.476 | 18.584 | 2.849 | 20 | +0.057 | 0.096 |
| Oct. | 1 | +0.2481 | -1.297 | -4.505 | +18.543 | +3.198 | -20 | +0.127 | -0.069 |

**BESSELIAN DAY NUMBERS, 2021.5**

FOR $0^h$ TERRESTRIAL TIME

| Date | | τ | A | B | C | D | E | dψ | dε |
|---|---|---|---|---|---|---|---|---|---|
| | | | " | " | " | " | s (0.0001) | | |
| Oct. | 1 | +0.2481 | -1.297 | -4.505 | +18.543 | +3.198 | -20 | +0.127 | -0.069 |
| | 2 | 0.2509 | 1.240 | 4.547 | 18.496 | 3.547 | 20 | 0.168 | -0.029 |
| | 3 | 0.2536 | 1.200 | 4.597 | 18.444 | 3.896 | 20 | 0.166 | +0.020 |
| | 4 | 0.2563 | 1.178 | 4.644 | 18.386 | 4.244 | 21 | 0.117 | 0.066 |
| | 5 | 0.2591 | 1.173 | 4.677 | 18.322 | 4.591 | 21 | +0.026 | 0.100 |
| | 6 | 0.2618 | 1.178 | 4.687 | 18.252 | 4.937 | 21 | -0.088 | 0.111 |
| | 7 | +0.2645 | -1.179 | -4.669 | +18.176 | +5.282 | -21 | -0.197 | +0.094 |
| | 8 | 0.2673 | 1.165 | 4.625 | 18.094 | 5.626 | 21 | 0.266 | +0.053 |
| | 9 | 0.2700 | 1.125 | 4.566 | 18.007 | 5.968 | 21 | 0.274 | -0.004 |
| | 10 | 0.2728 | 1.058 | 4.508 | 17.913 | 6.308 | 21 | 0.212 | 0.059 |
| | 11 | 0.2755 | 0.969 | 4.465 | 17.814 | 6.646 | 21 | -0.096 | 0.098 |
| | 12 | 0.2782 | 0.869 | 4.446 | 17.710 | 6.982 | 21 | +0.046 | 0.113 |
| | 13 | +0.2810 | -0.772 | -4.454 | +17.600 | +7.315 | -21 | +0.180 | -0.099 |
| | 14 | 0.2837 | 0.688 | 4.485 | 17.486 | 7.646 | 21 | 0.279 | 0.063 |
| | 15 | 0.2864 | 0.626 | 4.528 | 17.366 | 7.975 | 21 | 0.324 | -0.014 |
| | 16 | 0.2892 | 0.586 | 4.572 | 17.241 | 8.302 | 21 | 0.311 | +0.037 |
| | 17 | 0.2919 | 0.565 | 4.608 | 17.111 | 8.625 | 21 | 0.247 | 0.079 |
| | 18 | 0.2947 | 0.559 | 4.626 | 16.977 | 8.947 | 21 | 0.148 | 0.105 |
| | 19 | +0.2974 | -0.558 | -4.623 | +16.837 | +9.266 | -21 | +0.034 | +0.110 |
| | 20 | 0.3001 | 0.553 | 4.601 | 16.693 | 9.583 | 21 | -0.074 | 0.096 |
| | 21 | 0.3029 | 0.540 | 4.561 | 16.544 | 9.897 | 22 | 0.159 | 0.065 |
| | 22 | 0.3056 | 0.512 | 4.511 | 16.391 | 10.209 | 22 | 0.209 | +0.024 |
| | 23 | 0.3084 | 0.467 | 4.457 | 16.232 | 10.518 | 22 | 0.219 | -0.020 |
| | 24 | 0.3111 | 0.407 | 4.408 | 16.068 | 10.825 | 22 | 0.192 | 0.060 |
| | 25 | +0.3138 | -0.334 | -4.368 | +15.900 | +11.129 | -22 | -0.133 | -0.089 |
| | 26 | 0.3166 | 0.252 | 4.343 | 15.727 | 11.430 | 22 | -0.056 | 0.104 |
| | 27 | 0.3193 | 0.168 | 4.335 | 15.549 | 11.729 | 21 | +0.027 | 0.101 |
| | 28 | 0.3220 | 0.088 | 4.345 | 15.366 | 12.024 | 21 | 0.099 | 0.080 |
| | 29 | 0.3248 | -0.017 | 4.368 | 15.178 | 12.316 | 21 | 0.147 | -0.045 |
| | 30 | 0.3275 | +0.041 | 4.402 | 14.985 | 12.606 | 21 | 0.158 | 0.000 |
| | 31 | +0.3303 | +0.081 | -4.437 | +14.787 | +12.892 | -21 | +0.125 | +0.047 |
| Nov. | 1 | 0.3330 | 0.105 | 4.465 | 14.585 | 13.174 | 21 | +0.050 | 0.087 |
| | 2 | 0.3357 | 0.117 | 4.474 | 14.377 | 13.453 | 22 | -0.058 | 0.108 |
| | 3 | 0.3385 | 0.127 | 4.457 | 14.164 | 13.729 | 22 | 0.174 | 0.104 |
| | 4 | 0.3412 | 0.146 | 4.413 | 13.946 | 14.000 | 22 | 0.265 | 0.072 |
| | 5 | 0.3439 | 0.189 | 4.347 | 13.724 | 14.267 | 22 | 0.300 | +0.019 |
| | 6 | +0.3467 | +0.262 | -4.275 | +13.497 | +14.529 | -22 | -0.262 | -0.041 |
| | 7 | 0.3494 | 0.363 | 4.213 | 13.265 | 14.787 | 22 | 0.154 | 0.090 |
| | 8 | 0.3522 | 0.481 | 4.176 | 13.029 | 15.040 | 21 | -0.005 | 0.115 |
| | 9 | 0.3549 | 0.601 | 4.169 | 12.789 | 15.287 | 21 | +0.149 | 0.109 |
| | 10 | 0.3576 | 0.710 | 4.189 | 12.544 | 15.530 | 21 | 0.269 | 0.077 |
| | 11 | 0.3604 | 0.796 | 4.225 | 12.297 | 15.768 | 21 | 0.335 | -0.028 |
| | 12 | +0.3631 | +0.859 | -4.265 | +12.045 | +16.001 | -21 | +0.337 | +0.025 |
| | 13 | 0.3658 | 0.900 | 4.299 | 11.790 | 16.229 | 21 | 0.284 | 0.071 |
| | 14 | 0.3686 | 0.926 | 4.317 | 11.532 | 16.452 | 21 | 0.191 | 0.101 |
| | 15 | 0.3713 | 0.944 | 4.315 | 11.271 | 16.670 | 21 | +0.079 | 0.112 |
| | 16 | +0.3741 | +0.964 | -4.294 | +11.006 | +16.884 | -21 | -0.033 | +0.102 |

**BESSELIAN DAY NUMBERS, 2021.5**
FOR $0^h$ TERRESTRIAL TIME

| Date | | τ | A | B | C | D | E | dψ | dε |
|---|---|---|---|---|---|---|---|---|---|
| | | | " | " | " | " | s (0.0001) | | |
| Nov. | 16 | +0.3741 | +0.964 | -4.294 | +11.006 | +16.884 | -21 | -0.033 | +0.102 |
| | 17 | 0.3768 | 0.992 | 4.255 | 10.738 | 17.092 | 21 | 0.126 | 0.075 |
| | 18 | 0.3795 | 1.033 | 4.205 | 10.466 | 17.296 | 21 | 0.187 | +0.036 |
| | 19 | 0.3823 | 1.090 | 4.150 | 10.192 | 17.494 | 21 | 0.209 | -0.007 |
| | 20 | 0.3850 | 1.163 | 4.097 | 9.914 | 17.688 | 21 | 0.193 | 0.049 |
| | 21 | 0.3877 | 1.250 | 4.054 | 9.634 | 17.877 | 21 | 0.143 | 0.082 |
| | 22 | +0.3905 | +1.347 | -4.025 | +9.350 | +18.060 | -21 | -0.070 | -0.100 |
| | 23 | 0.3932 | 1.447 | 4.013 | 9.063 | 18.239 | 21 | +0.011 | 0.103 |
| | 24 | 0.3960 | 1.546 | 4.019 | 8.773 | 18.412 | 21 | 0.085 | 0.087 |
| | 25 | 0.3987 | 1.636 | 4.040 | 8.481 | 18.581 | 21 | 0.138 | 0.056 |
| | 26 | 0.4014 | 1.714 | 4.073 | 8.185 | 18.744 | 21 | 0.157 | -0.015 |
| | 27 | 0.4042 | 1.776 | 4.110 | 7.886 | 18.901 | 21 | 0.135 | +0.031 |
| | 28 | +0.4069 | +1.822 | -4.143 | +7.585 | +19.053 | -21 | +0.071 | +0.072 |
| | 29 | 0.4097 | 1.854 | 4.164 | 7.281 | 19.200 | 21 | -0.027 | 0.100 |
| | 30 | 0.4124 | 1.881 | 4.163 | 6.973 | 19.341 | 21 | 0.143 | 0.106 |
| Dec. | 1 | 0.4151 | 1.911 | 4.137 | 6.663 | 19.476 | 21 | 0.249 | 0.086 |
| | 2 | 0.4179 | 1.958 | 4.087 | 6.351 | 19.604 | 21 | 0.314 | +0.042 |
| | 3 | 0.4206 | 2.033 | 4.023 | 6.036 | 19.727 | 21 | 0.312 | -0.017 |
| | 4 | +0.4233 | +2.138 | -3.961 | +5.718 | +19.843 | -21 | -0.233 | -0.074 |
| | 5 | 0.4261 | 2.268 | 3.919 | 5.398 | 19.952 | 20 | -0.092 | 0.111 |
| | 6 | 0.4288 | 2.410 | 3.908 | 5.077 | 20.055 | 20 | +0.075 | 0.119 |
| | 7 | 0.4316 | 2.544 | 3.929 | 4.754 | 20.151 | 20 | 0.224 | 0.095 |
| | 8 | 0.4343 | 2.659 | 3.974 | 4.429 | 20.240 | 20 | 0.322 | -0.048 |
| | 9 | 0.4370 | 2.746 | 4.029 | 4.104 | 20.323 | 20 | 0.351 | +0.008 |
| | 10 | +0.4398 | +2.808 | -4.079 | +3.777 | +20.399 | -20 | +0.316 | +0.060 |
| | 11 | 0.4425 | 2.852 | 4.115 | 3.450 | 20.468 | 20 | 0.233 | 0.096 |
| | 12 | 0.4452 | 2.885 | 4.131 | 3.122 | 20.532 | 20 | 0.123 | 0.112 |
| | 13 | 0.4480 | 2.916 | 4.128 | 2.793 | 20.589 | 20 | +0.009 | 0.107 |
| | 14 | 0.4507 | 2.954 | 4.106 | 2.463 | 20.640 | 20 | -0.090 | 0.084 |
| | 15 | 0.4535 | 3.004 | 4.072 | 2.133 | 20.684 | 20 | 0.159 | 0.048 |
| | 16 | +0.4562 | +3.068 | -4.032 | +1.802 | +20.723 | -20 | -0.192 | +0.005 |
| | 17 | 0.4589 | 3.149 | 3.993 | 1.471 | 20.755 | 20 | 0.185 | -0.038 |
| | 18 | 0.4617 | 3.243 | 3.962 | 1.139 | 20.781 | 20 | 0.143 | 0.073 |
| | 19 | 0.4644 | 3.348 | 3.944 | 0.807 | 20.801 | 19 | -0.075 | 0.096 |
| | 20 | 0.4671 | 3.458 | 3.944 | 0.475 | 20.815 | 19 | +0.005 | 0.102 |
| | 21 | 0.4699 | 3.566 | 3.962 | +0.142 | 20.823 | 19 | 0.082 | 0.091 |
| | 22 | +0.4726 | +3.668 | -3.996 | -0.190 | +20.825 | -19 | +0.141 | -0.064 |
| | 23 | 0.4754 | 3.756 | 4.043 | 0.523 | 20.821 | 19 | 0.167 | -0.025 |
| | 24 | 0.4781 | 3.829 | 4.097 | 0.857 | 20.810 | 19 | 0.154 | +0.019 |
| | 25 | 0.4808 | 3.885 | 4.148 | 1.190 | 20.793 | 19 | 0.099 | 0.061 |
| | 26 | 0.4836 | 3.927 | 4.189 | 1.523 | 20.770 | 19 | +0.008 | 0.092 |
| | 27 | 0.4863 | 3.960 | 4.213 | 1.856 | 20.741 | 19 | -0.104 | 0.104 |
| | 28 | +0.4890 | +3.993 | -4.214 | -2.189 | +20.705 | -19 | -0.216 | +0.094 |
| | 29 | 0.4918 | 4.036 | 4.192 | 2.522 | 20.663 | 19 | 0.301 | 0.059 |
| | 30 | 0.4945 | 4.101 | 4.152 | 2.854 | 20.614 | 19 | 0.333 | +0.007 |
| | 31 | 0.4973 | 4.194 | 4.108 | 3.186 | 20.558 | 19 | 0.292 | -0.051 |
| | 32 | +0.5000 | +4.315 | -4.075 | -3.518 | +20.496 | -19 | -0.182 | -0.099 |

## SECOND-ORDER DAY NUMBERS, 2021

J FOR NORTHERN DECLINATIONS

FOR $0^h$ TT AND EQUINOX J 2021.5

| Date | | RIGHT ASCENSION | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $0^h$ $12^h$ | $1^h$ $13^h$ | $2^h$ $14^h$ | $3^h$ $15^h$ | $4^h$ $16^h$ | $5^h$ $17^h$ | $6^h$ $18^h$ | $7^h$ $19^h$ | $8^h$ $20^h$ | $9^h$ $21^h$ | $10^h$ $22^h$ | $11^h$ $23^h$ | $12^h$ $24^h$ |
| Jan. | -3 | -1 | -1 | -1 | -1 | 0 | 0 | 0 | +0 | 0 | 0 | -1 | -1 | -1 |
| | 7 | -1 | -2 | -1 | -1 | -1 | 0 | 0 | +1 | 0 | 0 | 0 | -1 | -1 |
| | 17 | -2 | -2 | -2 | -2 | -1 | 0 | +1 | +1 | +1 | +1 | 0 | -1 | -2 |
| | 27 | -1 | -3 | -3 | -3 | -2 | -1 | 0 | +2 | +2 | +2 | +1 | 0 | -1 |
| Feb. | 6 | -1 | -3 | -4 | -5 | -4 | -3 | 0 | +2 | +3 | +4 | +3 | +2 | -1 |
| | 16 | +1 | -2 | -5 | -6 | -6 | -4 | -2 | +1 | +4 | +5 | +5 | +3 | +1 |
| | 26 | +3 | -1 | -4 | -7 | -7 | -6 | -4 | 0 | +3 | +6 | +6 | +5 | +3 |
| Mar. | 8 | +5 | +1 | -3 | -7 | -9 | -8 | -6 | -2 | +2 | +6 | +8 | +7 | +5 |
| | 18 | +7 | +4 | -1 | -6 | -9 | -10 | -8 | -5 | 0 | +5 | +8 | +9 | +7 |
| | 28 | +10 | +6 | +1 | -5 | -9 | -12 | -11 | -7 | -2 | +4 | +8 | +11 | +10 |
| Apr. | 7 | +11 | +8 | +3 | -3 | -8 | -12 | -12 | -9 | -4 | +2 | +7 | +11 | +11 |
| | 17 | +12 | +11 | +6 | +0 | -7 | -12 | -13 | -12 | -7 | -1 | +6 | +11 | +12 |
| | 27 | +13 | +12 | +9 | +2 | -5 | -10 | -14 | -13 | -10 | -3 | +4 | +9 | +13 |
| May | 7 | +12 | +13 | +11 | +5 | -2 | -9 | -13 | -14 | -12 | -6 | +1 | +8 | +12 |
| | 17 | +11 | +13 | +12 | +8 | +1 | -6 | -12 | -14 | -13 | -9 | -2 | +5 | +11 |
| | 27 | +9 | +12 | +13 | +10 | +4 | -3 | -10 | -13 | -14 | -11 | -5 | +2 | +9 |
| June | 6 | +6 | +11 | +13 | +11 | +6 | -1 | -7 | -12 | -14 | -12 | -7 | +0 | +6 |
| | 16 | +3 | +9 | +12 | +11 | +8 | +2 | -4 | -10 | -13 | -12 | -9 | -3 | +3 |
| | 26 | +1 | +6 | +10 | +11 | +9 | +4 | -2 | -7 | -11 | -12 | -10 | -5 | +1 |
| July | 6 | -2 | +4 | +8 | +10 | +9 | +6 | +1 | -5 | -9 | -11 | -10 | -7 | -2 |
| | 16 | -4 | +1 | +5 | +8 | +9 | +7 | +3 | -2 | -6 | -9 | -10 | -8 | -4 |
| | 26 | -5 | -1 | +3 | +6 | +7 | +7 | +4 | +0 | -4 | -7 | -8 | -8 | -5 |
| Aug. | 5 | -6 | -3 | +0 | +4 | +6 | +6 | +5 | +2 | -1 | -5 | -7 | -7 | -6 |
| | 15 | -6 | -4 | -2 | +2 | +4 | +5 | +5 | +3 | +1 | -3 | -5 | -6 | -6 |
| | 25 | -5 | -5 | -3 | -1 | +2 | +4 | +4 | +4 | +2 | +0 | -3 | -5 | -5 |
| Sept. | 4 | -6 | -8 | -8 | -5 | -2 | +2 | +5 | +7 | +7 | +4 | +1 | -3 | -6 |
| | 14 | -4 | -5 | -4 | -2 | 0 | +2 | +3 | +4 | +3 | +1 | -1 | -3 | -4 |
| | 24 | -1 | -2 | -3 | -4 | -3 | -2 | +0 | +1 | +2 | +3 | +2 | +1 | -1 |
| Oct. | 4 | +1 | -1 | -2 | -3 | -4 | -3 | -2 | 0 | +1 | +2 | +3 | +2 | +1 |
| | 14 | +2 | +1 | -1 | -2 | -4 | -4 | -3 | -2 | +0 | +1 | +3 | +3 | +2 |
| | 24 | +3 | +3 | +1 | -1 | -3 | -4 | -4 | -4 | -2 | +0 | +2 | +3 | +3 |
| Nov. | 3 | +4 | +4 | +3 | +1 | -1 | -3 | -5 | -5 | -4 | -2 | 0 | +2 | +4 |
| | 13 | +4 | +5 | +5 | +3 | +1 | -2 | -5 | -6 | -6 | -4 | -2 | +1 | +4 |
| | 23 | +3 | +5 | +6 | +5 | +3 | 0 | -4 | -6 | -7 | -6 | -4 | -1 | +3 |
| Dec. | 3 | +5 | +7 | +7 | +5 | +2 | -2 | -6 | -8 | -8 | -6 | -3 | +1 | +5 |
| | 13 | -2 | +3 | +7 | +8 | +8 | +5 | +1 | -4 | -8 | -9 | -9 | -6 | -2 |
| | 23 | -4 | +1 | +6 | +9 | 9 | +7 | +3 | -2 | -7 | -10 | -10 | -8 | -4 |
| | 33 | -7 | -2 | +4 | +8 | +10 | +10 | +6 | +1 | -5 | -9 | -11 | -11 | -7 |

The second-order day number J given in this table in units of $0^s.00001$

The apparent right ascension of a star is given by:

$$\alpha = \alpha_1 + \tau\mu_\alpha/100 + Aa + Bb + Cc + Dd + E + J\tan^2\delta_1$$

Where the position ($\alpha_1$, $\delta_1$) and centennial proper motion in right ascension ($\mu_\alpha$) are referred to the mean equator and equinox of J 2021.5

**SECOND-ORDER DAY NUMBERS, 2021**

J' FOR NORTHERN DECLINATIONS

FOR $0^h$ TT AND EQUINOX J 2021.5

| Date | | RIGHT ASCENSION | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $0^h$ $12^h$ | $1^h$ $13^h$ | $2^h$ $14^h$ | $3^h$ $15^h$ | $4^h$ $16^h$ | $5^h$ $17^h$ | $6^h$ $18^h$ | $7^h$ $19^h$ | $8^h$ $20^h$ | $9^h$ $21^h$ | $10^h$ $22^h$ | $11^h$ $23^h$ | $12^h$ $24^h$ |
| Jan. | -3 | 0 | 0 | -1 | -1 | -1 | -1 | -1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 7 | -1 | 0 | 0 | -1 | -1 | -1 | -1 | -1 | -2 | -2 | -2 | -1 | -1 |
| | 17 | -3 | -3 | -1 | 0 | 0 | 0 | -1 | -1 | -2 | -3 | -3 | -3 | -2 |
| | 27 | -5 | -4 | -3 | -2 | -1 | -1 | -1 | -1 | -2 | -3 | -4 | -5 | -5 |
| Feb. | 6 | -7 | -6 | -5 | -4 | -2 | -1 | -1 | -1 | -2 | -4 | -5 | -6 | -7 |
| | 16 | -9 | -9 | -8 | -6 | -4 | -2 | -1 | -1 | -2 | -4 | -6 | -8 | -9 |
| | 26 | -10 | -11 | -10 | -8 | -5 | -3 | -1 | -1 | -1 | -3 | -6 | -9 | -10 |
| Mar. | 8 | -11 | -13 | -13 | -11 | -8 | -5 | -2 | -1 | -1 | -3 | -6 | -9 | -11 |
| | 18 | -12 | -15 | -15 | -14 | -11 | -7 | -4 | -1 | -1 | -2 | -5 | -9 | -12 |
| | 28 | -12 | -16 | -17 | -16 | -14 | -10 | -5 | -2 | -1 | -1 | -4 | -8 | -12 |
| Apr. | 7 | -11 | -15 | -18 | -18 | -16 | -12 | -8 | -3 | -1 | -1 | -3 | -7 | -11 |
| | 17 | -10 | -15 | -18 | -20 | -19 | -15 | -10 | -6 | -2 | -1 | -2 | -5 | -10 |
| | 27 | -8 | -14 | -18 | -21 | -20 | -18 | -13 | -8 | -3 | -1 | -1 | -4 | -8 |
| May | 7 | -7 | -12 | -17 | -20 | -21 | -19 | -15 | -10 | -5 | -1 | -1 | -2 | -7 |
| | 17 | -5 | -10 | -15 | -19 | -21 | -20 | -17 | -12 | -7 | -3 | -1 | -1 | -5 |
| | 27 | -3 | -8 | -13 | -18 | -20 | -21 | -18 | -14 | -9 | -4 | -1 | -1 | -3 |
| June | 6 | -2 | -6 | -10 | -15 | -19 | -20 | -19 | -15 | -10 | -5 | -2 | -1 | -2 |
| | 16 | -1 | -4 | -8 | -13 | -17 | -19 | -19 | -16 | -12 | -7 | -3 | -1 | -1 |
| | 26 | -1 | -2 | -5 | -10 | -14 | -17 | -18 | -16 | -13 | -8 | -4 | -1 | -1 |
| July | 6 | -1 | -1 | -4 | -7 | -11 | -15 | -16 | -16 | -13 | -9 | -5 | -2 | -1 |
| | 16 | -1 | -1 | -2 | -5 | -9 | -12 | -14 | -14 | -13 | -10 | -6 | -3 | -1 |
| | 26 | -2 | -1 | -1 | -3 | -6 | -9 | -11 | -13 | -12 | -10 | -7 | -4 | -2 |
| Aug. | 5 | -3 | -1 | -1 | -2 | -4 | -6 | -9 | -11 | -11 | -10 | -8 | -5 | -3 |
| | 15 | -3 | -2 | -1 | -1 | -2 | -4 | -6 | -8 | -9 | -9 | -8 | -6 | -3 |
| | 25 | -4 | -2 | -1 | -1 | -1 | -2 | -4 | -6 | -7 | -8 | -7 | -6 | -4 |
| Sept. | 4 | -5 | -3 | -2 | -1 | -1 | -1 | -2 | -4 | -5 | -6 | -7 | -6 | -5 |
| | 14 | -5 | -4 | -3 | -2 | -1 | -1 | -1 | -2 | -4 | -5 | -6 | -6 | -5 |
| | 24 | -5 | -5 | -4 | -3 | -1 | -1 | -1 | -1 | -2 | -3 | -4 | -5 | -5 |
| Oct. | 4 | -5 | -5 | -5 | -4 | -3 | -2 | -1 | -1 | -1 | -2 | -3 | -4 | -5 |
| | 14 | -5 | -5 | -6 | -5 | -4 | -3 | -2 | -1 | -1 | -1 | -2 | -3 | -5 |
| | 24 | -4 | -5 | -6 | -6 | -6 | -5 | -3 | -2 | -1 | -1 | -1 | -2 | -4 |
| Nov. | 3 | -3 | -5 | -6 | -7 | -7 | -7 | -5 | -3 | -2 | -1 | -1 | -1 | -3 |
| | 13 | -2 | -4 | -6 | -8 | -9 | -9 | -8 | -6 | -3 | -2 | -1 | -1 | -2 |
| | 23 | -1 | -3 | -5 | -8 | -10 | -11 | -10 | -8 | -6 | -3 | -1 | -1 | -1 |
| Dec. | 3 | -1 | -2 | -4 | -7 | -10 | -12 | -12 | -11 | -8 | -5 | -3 | -1 | -1 |
| | 13 | -1 | -1 | -3 | -6 | -10 | -13 | -14 | -13 | -11 | -8 | -5 | -2 | -1 |
| | 23 | -1 | -1 | -2 | -5 | -9 | -13 | -15 | -16 | -14 | -11 | -7 | -3 | -1 |
| | 33 | -2 | -1 | -1 | -4 | -8 | -12 | -16 | -17 | -16 | -14 | -10 | -5 | -2 |

The second-order day number J' given in this table in units of 0".0001

The apparent declination of a star is given by:

$\delta = \delta_1 + \tau\mu_\delta/100 + Aa' + Bb' + Cc' + J' \tan\delta_1$

Where the declination ($\delta_1$) and centennial proper motion in declination ($\mu_\delta$) are referred to the mean equator and equinox of J 2021.5

**SECOND-ORDER DAY NUMBERS, 2021**
J FOR SOUTHERN DECLINATIONS
FOR $0^h$ TT AND EQUINOX J 2021.5

| Date | | RIGHT ASCENSION | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $0^h$ $12^h$ | $1^h$ $13^h$ | $2^h$ $14^h$ | $3^h$ $15^h$ | $4^h$ $16^h$ | $5^h$ $17^h$ | $6^h$ $18^h$ | $7^h$ $19^h$ | $8^h$ $20^h$ | $9^h$ $21^h$ | $10^h$ $22^h$ | $11^h$ $23^h$ | $12^h$ $24^h$ |
| Jan. | -3 | -3 | +8 | +17 | +22 | +20 | +13 | +2 | -9 | -18 | -23 | -21 | -14 | -3 |
| | 7 | -5 | +6 | +15 | +20 | +20 | +14 | +4 | -7 | -16 | -21 | -21 | -15 | -5 |
| | 17 | -8 | +2 | +11 | +17 | +19 | +15 | +7 | -3 | -12 | -18 | -20 | -16 | -8 |
| | 27 | -10 | -2 | +7 | +14 | +17 | +15 | +9 | +1 | -8 | -15 | -18 | -16 | -10 |
| Feb. | 6 | -11 | -4 | +3 | +10 | +14 | +14 | +10 | +3 | -4 | -11 | -15 | -15 | -11 |
| | 16 | -11 | -6 | 0 | +7 | +11 | +12 | +10 | +5 | -1 | -8 | -12 | -13 | -11 |
| | 26 | -11 | -7 | -2 | +3 | +8 | +10 | +10 | +6 | +1 | -4 | -9 | -11 | -11 |
| Mar. | 8 | -9 | -8 | -4 | 0 | +5 | +8 | +8 | +7 | +3 | -1 | -6 | -9 | -9 |
| | 18 | -7 | -7 | -5 | -2 | +2 | +5 | +6 | +6 | +4 | +1 | -3 | -6 | -7 |
| | 28 | -5 | -6 | -5 | -3 | 0 | +2 | +4 | +5 | +4 | +2 | -1 | -3 | -5 |
| Apr. | 7 | -3 | -4 | -5 | -4 | -2 | 0 | +2 | +3 | +4 | +3 | +1 | -1 | -3 |
| | 17 | -1 | -3 | -4 | -4 | -3 | -1 | 0 | +2 | +3 | +3 | +2 | +0 | -1 |
| | 27 | +0 | -1 | -2 | -3 | -3 | -2 | -1 | +0 | +1 | +2 | +2 | +1 | 0 |
| May | 7 | +1 | +0 | -1 | -2 | -2 | -2 | -2 | -1 | 0 | +1 | +1 | +1 | +1 |
| | 17 | +1 | +1 | 0 | -1 | -2 | -2 | -2 | -2 | -1 | 0 | +1 | +1 | +1 |
| | 27 | +1 | +1 | +1 | +1 | +0 | -1 | -2 | -2 | -2 | -2 | -1 | 0 | +1 |
| June | 6 | 0 | +1 | +2 | +2 | +1 | 0 | -1 | -2 | -3 | -3 | -2 | -1 | 0 |
| | 16 | -1 | +0 | +2 | +2 | +2 | +1 | +0 | -1 | -3 | -3 | -3 | -2 | -1 |
| | 26 | -2 | -1 | +1 | +2 | +3 | +2 | +1 | 0 | -2 | -3 | -4 | -3 | -2 |
| July | 6 | -4 | -2 | 0 | +2 | +3 | +3 | +3 | +1 | -1 | -3 | -4 | -4 | -4 |
| | 16 | -5 | -4 | -2 | 0 | +3 | +4 | +4 | +3 | +1 | -1 | -4 | -5 | -5 |
| | 26 | -6 | -5 | -4 | -1 | +2 | +4 | +5 | +4 | +3 | 0 | -3 | -5 | -6 |
| Aug. | 5 | -6 | -7 | -5 | -3 | 0 | +3 | +5 | +6 | +4 | +2 | -1 | -4 | -6 |
| | 15 | -6 | -7 | -7 | -5 | -2 | +2 | +5 | +6 | +6 | +4 | +1 | -3 | -6 |
| | 25 | -5 | -7 | -8 | -7 | -4 | 0 | +4 | +6 | +7 | +6 | +3 | -1 | -5 |
| Sept. | 4 | -3 | -7 | -8 | -8 | -6 | -2 | +2 | +6 | +7 | +7 | +5 | +1 | -3 |
| | 14 | -1 | -5 | -8 | -9 | -8 | -4 | 0 | +4 | +7 | +8 | +7 | +3 | -1 |
| | 24 | +1 | -3 | -7 | -9 | -9 | -6 | -2 | +2 | +6 | +8 | +8 | +5 | +1 |
| Oct. | 4 | +4 | -1 | -5 | -9 | -10 | -8 | -5 | 0 | +4 | +8 | +9 | +7 | +4 |
| | 14 | +5 | +1 | -3 | -7 | -9 | -9 | -6 | -2 | +2 | +6 | +8 | +8 | +5 |
| | 24 | +7 | +4 | -1 | -5 | -8 | -9 | -8 | -5 | +0 | +4 | +7 | +8 | +7 |
| Nov. | 3 | +8 | +5 | +1 | -3 | -7 | -9 | -9 | -6 | -2 | +2 | +6 | +8 | +8 |
| | 13 | +7 | +6 | +3 | -1 | -5 | -8 | -8 | -7 | -4 | 0 | +4 | +7 | +7 |
| | 23 | +7 | +7 | +5 | +1 | -2 | -6 | -8 | -8 | -6 | -2 | +1 | +5 | +7 |
| Dec. | 3 | +5 | +6 | +5 | +3 | 0 | -4 | -6 | -7 | -6 | -4 | -1 | +3 | +5 |
| | 13 | +3 | +5 | +5 | +4 | +1 | -2 | -4 | -6 | -6 | -5 | -2 | +1 | +3 |
| | 23 | +1 | +3 | +4 | +4 | +2 | 0 | -2 | -4 | -5 | -5 | -3 | -1 | +1 |
| | 33 | 0 | +2 | +3 | +4 | +3 | +1 | -1 | -3 | -4 | -5 | -4 | -2 | 0 |

The second-order day number J given in this table in units of $0^s.00001$

The apparent right ascension of a star is given by:

$$\alpha = \alpha_1 + \tau\mu_\alpha/100 + Aa + Bb + Cc + Dd + E + J\tan^2\delta_1$$

Where the position ($\alpha_1$, $\delta_1$) and centennial proper motion in right ascension ($\mu_\alpha$) are referred to the mean equator and equinox of J 2021.5

**SECOND-ORDER DAY NUMBERS, 2021**
J' FOR SOUTHERN DECLINATIONS
FOR $0^h$ TT AND EQUINOX J 2021.5

| Date | | RIGHT ASCENSION | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $0^h$ $12^h$ | $1^h$ $13^h$ | $2^h$ $14^h$ | $3^h$ $15^h$ | $4^h$ $16^h$ | $5^h$ $17^h$ | $6^h$ $18^h$ | $7^h$ $19^h$ | $8^h$ $20^h$ | $9^h$ $21^h$ | $10^h$ $22^h$ | $11^h$ $23^h$ | $12^h$ $24^h$ |
| Jan. | -3 | -1 | -2 | -7 | -15 | -24 | -31 | -34 | -33 | -27 | -19 | -11 | -4 | -1 |
| | 7 | -1 | -1 | -6 | -13 | -21 | -28 | -32 | -32 | -27 | -20 | -12 | -5 | -1 |
| | 17 | -2 | -1 | -3 | -9 | -17 | -24 | -28 | -29 | -27 | -21 | -13 | -6 | -2 |
| | 27 | -3 | -1 | -2 | -6 | -13 | -19 | -24 | -26 | -25 | -21 | -14 | -8 | -3 |
| Feb. | 6 | -4 | -1 | -1 | -4 | -9 | -15 | -20 | -23 | -23 | -20 | -15 | -9 | -4 |
| | 16 | -5 | -2 | -1 | -2 | -6 | -11 | -16 | -19 | -20 | -18 | -15 | -10 | -5 |
| | 26 | -6 | -2 | -1 | -1 | -3 | -7 | -11 | -15 | -17 | -16 | -14 | -10 | -6 |
| Mar. | 8 | -6 | -3 | -1 | -1 | -2 | -4 | -8 | -11 | -13 | -14 | -12 | -10 | -6 |
| | 18 | -7 | -4 | -2 | -1 | -1 | -2 | -5 | -8 | -10 | -11 | -11 | -9 | -7 |
| | 28 | -6 | -4 | -2 | -1 | -1 | -1 | -3 | -5 | -7 | -8 | -9 | -8 | -6 |
| Apr. | 7 | -6 | -5 | -3 | -2 | -1 | -1 | -1 | -3 | -4 | -6 | -6 | -7 | -6 |
| | 17 | -5 | -4 | -3 | -2 | -1 | -1 | -1 | -1 | -2 | -4 | -5 | -5 | -5 |
| | 27 | -4 | -4 | -3 | -3 | -2 | -1 | -1 | -1 | -1 | -2 | -3 | -4 | -4 |
| May | 7 | -3 | -3 | -3 | -3 | -2 | -2 | -1 | -1 | -1 | -1 | -1 | -2 | -3 |
| | 17 | -2 | -3 | -3 | -3 | -3 | -3 | -2 | -1 | -1 | -1 | -1 | -1 | -2 |
| | 27 | -1 | -2 | -3 | -3 | -3 | -3 | -3 | -2 | -1 | -1 | -1 | -1 | -1 |
| June | 6 | -1 | -1 | -2 | -3 | -3 | -4 | -4 | -3 | -2 | -2 | -1 | -1 | -1 |
| | 16 | -1 | -1 | -1 | -2 | -3 | -4 | -4 | -4 | -4 | -3 | -2 | -1 | -1 |
| | 26 | -1 | -1 | -1 | -2 | -3 | -4 | -5 | -5 | -5 | -4 | -3 | -2 | -1 |
| July | 6 | -2 | -1 | -1 | -1 | -2 | -4 | -5 | -6 | -6 | -6 | -5 | -3 | -2 |
| | 16 | -3 | -2 | -1 | -1 | -1 | -3 | -5 | -6 | -7 | -7 | -7 | -5 | -3 |
| | 26 | -5 | -3 | -1 | -1 | -1 | -2 | -4 | -6 | -8 | -9 | -8 | -7 | -5 |
| Aug. | 5 | -7 | -4 | -2 | -1 | -1 | -1 | -3 | -6 | -8 | -9 | -10 | -9 | -7 |
| | 15 | -9 | -7 | -4 | -2 | -1 | -1 | -2 | -5 | -7 | -10 | -11 | -10 | -9 |
| | 25 | -11 | -9 | -6 | -3 | -1 | -1 | -1 | -4 | -7 | -9 | -11 | -12 | -11 |
| Sept. | 4 | -12 | -10 | -8 | -5 | -2 | -1 | -1 | -3 | -5 | -9 | -11 | -12 | -12 |
| | 14 | -13 | -12 | -10 | -6 | -3 | -1 | -1 | -2 | -4 | -7 | -10 | -12 | -13 |
| | 24 | -14 | -13 | -12 | -9 | -5 | -2 | -1 | -1 | -3 | -6 | -9 | -12 | -14 |
| Oct. | 4 | -13 | -14 | -13 | -10 | -7 | -4 | -1 | -1 | -2 | -4 | -8 | -11 | -13 |
| | 14 | -12 | -14 | -14 | -12 | -9 | -5 | -2 | -1 | -1 | -3 | -6 | -9 | -12 |
| | 24 | -11 | -13 | -14 | -13 | -10 | -7 | -4 | -1 | -1 | -2 | -4 | -7 | -11 |
| Nov. | 3 | -9 | -12 | -13 | -13 | -11 | -8 | -5 | -2 | -1 | -1 | -3 | -6 | -9 |
| | 13 | -7 | -10 | -12 | -12 | -12 | -9 | -6 | -3 | -1 | -1 | -1 | -4 | -7 |
| | 23 | -5 | -7 | -10 | -11 | -11 | -10 | -7 | -4 | -2 | -1 | -1 | -2 | -5 |
| Dec. | 3 | -3 | -5 | -8 | -10 | -11 | -10 | -8 | -6 | -3 | -1 | -1 | -1 | -3 |
| | 13 | -2 | -4 | -6 | -8 | -9 | -9 | -8 | -6 | -4 | -2 | -1 | -1 | -2 |
| | 23 | -1 | -2 | -4 | -6 | -7 | -8 | -8 | -6 | -5 | -3 | -1 | -1 | -1 |
| | 33 | -1 | -1 | -2 | -4 | -5 | -6 | -7 | -6 | -5 | -4 | -2 | -1 | -1 |

The second-order day number J' given in this table in units of 0".0001

The apparent declination of a star is given by:
$\delta = \delta_1 + \tau\mu_\delta/100 + Aa' + Bb' + Cc' + J' \tan\delta_1$

Where the declination ($\delta_1$) and centennial proper motion in declination ($\mu_\delta$) are referred to the mean equator and equinox of J 2021.5

**POSITION AND VELOCITY OF THE EARTH, 2021**
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

| Date $0^h$ T.D.B. | | X | Y | Z | $\dot{X}$ | $\dot{Y}$ | $\dot{Z}$ |
|---|---|---|---|---|---|---|---|
| Jan. | 0 | -0.168 542 75 | +0.895 317 64 | +0.388 231 93 | -1725 0273 | -266 1361 | -115 4006 |
| | 1 | 0.185 767 25 | 0.892 518 59 | 0.387 018 28 | 1719 7901 | 293 6627 | 127 3237 |
| | 2 | 0.202 936 88 | 0.889 444 63 | 0.385 685 57 | 1714 0503 | 321 1162 | 139 2122 |
| | 3 | 0.220 046 58 | 0.886 096 51 | 0.384 234 15 | 1707 8056 | 348 4946 | 151 0658 |
| | 4 | 0.237 091 29 | 0.882 475 00 | 0.382 664 37 | 1701 0522 | 375 7950 | 162 8839 |
| | 5 | 0.254 065 91 | 0.878 580 89 | 0.380 976 59 | 1693 7841 | 403 0132 | 174 6656 |
| | 6 | -0.270 965 24 | +0.874 415 03 | +0.379 171 19 | -1685 9943 | -430 1429 | -186 4094 |
| | 7 | 0.287 784 03 | 0.869 978 35 | 0.377 248 54 | 1677 6749 | 457 1757 | 198 1124 |
| | 8 | 0.304 516 94 | 0.865 271 87 | 0.375 209 08 | 1668 8177 | 484 1009 | 209 7712 |
| | 9 | 0.321 158 56 | 0.860 296 74 | 0.373 053 28 | 1659 4157 | 510 9047 | 221 3806 |
| | 10 | 0.337 703 42 | 0.855 054 24 | 0.370 781 66 | 1649 4631 | 537 5708 | 232 9343 |
| | 11 | 0.354 145 98 | 0.849 545 84 | 0.368 394 81 | 1638 9569 | 564 0809 | 244 4248 |
| | 12 | -0.370 480 72 | +0.843 773 21 | +0.365 893 40 | -1627 8980 | -590 4152 | -255 8437 |
| | 13 | 0.386 702 12 | 0.837 738 19 | 0.363 278 20 | 1616 2912 | 616 5548 | 267 1822 |
| | 14 | 0.402 804 74 | 0.831 442 82 | 0.360 550 05 | 1604 1448 | 642 4812 | 278 4318 |
| | 15 | 0.418 783 25 | 0.824 889 32 | 0.357 709 89 | 1591 4703 | 668 1790 | 289 5849 |
| | 16 | 0.434 632 43 | 0.818 080 05 | 0.354 758 70 | 1578 2802 | 693 6355 | 300 6350 |
| | 17 | 0.450 347 18 | 0.811 017 45 | 0.351 697 55 | 1564 5875 | 718 8401 | 311 5768 |
| | 18 | -0.465 922 55 | +0.803 704 11 | +0.348 527 54 | -1550 4053 | -743 7848 | -322 4058 |
| | 19 | 0.481 353 69 | 0.796 142 65 | 0.345 249 82 | 1535 7454 | 768 4629 | 333 1185 |
| | 20 | 0.496 635 90 | 0.788 335 76 | 0.341 865 57 | 1520 6185 | 792 8684 | 343 7120 |
| | 21 | 0.511 764 54 | 0.780 286 21 | 0.338 375 99 | 1505 0353 | 816 9963 | 354 1832 |
| | 22 | 0.526 735 12 | 0.771 996 78 | 0.334 782 32 | 1489 0059 | 840 8417 | 364 5298 |
| | 23 | 0.541 543 20 | 0.763 470 33 | 0.331 085 81 | 1472 5395 | 864 4001 | 374 7496 |
| | 24 | -0.556 184 48 | +0.754 709 75 | +0.327 287 76 | -1455 6460 | -887 6677 | -384 8404 |
| | 25 | 0.570 654 73 | 0.745 717 95 | 0.323 389 44 | 1438 3351 | 910 6414 | 394 8009 |
| | 26 | 0.584 949 82 | 0.736 497 91 | 0.319 392 18 | 1420 6157 | 933 3189 | 404 6295 |
| | 27 | 0.599 065 72 | 0.727 052 57 | 0.315 297 29 | 1402 4966 | 955 6993 | 414 3261 |
| | 28 | 0.612 998 45 | 0.717 384 91 | 0.311 106 10 | 1383 9852 | 977 7826 | 423 8906 |
| | 29 | 0.626 744 13 | 0.707 497 90 | 0.306 819 92 | 1365 0870 | 999 5698 | 433 3235 |
| | 30 | -0.640 298 91 | +0.697 394 50 | +0.302 440 06 | -1345 8052 | -1021 0619 | -442 6260 |
| | 31 | 0.653 658 96 | 0.687 077 65 | 0.297 967 83 | 1326 1404 | 1042 2594 | 451 7990 |
| Feb. | 1 | 0.666 820 44 | 0.676 550 30 | 0.293 404 51 | 1306 0910 | 1063 1612 | 460 8430 |
| | 2 | 0.679 779 48 | 0.665 815 42 | 0.288 751 40 | 1285 6536 | 1083 7641 | 469 7575 |
| | 3 | 0.692 532 20 | 0.654 876 03 | 0.284 009 80 | 1264 8240 | 1104 0619 | 478 5411 |
| | 4 | 0.705 074 64 | 0.643 735 23 | 0.279 181 02 | 1243 5983 | 1124 0461 | 487 1911 |
| | 5 | -0.717 402 84 | +0.632 396 19 | +0.274 266 43 | -1221 9738 | -1143 7052 | -495 7031 |
| | 6 | 0.729 512 79 | 0.620 862 25 | 0.269 267 44 | 1199 9498 | 1163 0259 | 504 0724 |
| | 7 | 0.741 400 51 | 0.609 136 85 | 0.264 185 48 | 1177 5279 | 1181 9936 | 512 2927 |
| | 8 | 0.753 062 04 | 0.597 223 61 | 0.259 022 10 | 1154 7130 | 1200 5928 | 520 3575 |
| | 9 | 0.764 493 48 | 0.585 126 28 | 0.253 778 87 | 1131 5125 | 1218 8081 | 528 2598 |
| | 10 | 0.775 691 04 | 0.572 848 77 | 0.248 457 47 | 1107 9372 | 1236 6252 | 535 9928 |
| | 11 | -0.786 651 02 | +0.560 395 14 | +0.243 059 60 | -1084 0004 | -1254 0308 | -543 5504 |
| | 12 | 0.797 369 89 | 0.547 769 56 | 0.237 587 06 | 1059 7170 | 1271 0145 | 550 9269 |
| | 13 | 0.807 844 26 | 0.534 976 29 | 0.232 041 68 | 1035 1032 | 1287 5677 | 558 1177 |
| | 14 | 0.818 070 91 | 0.522 019 66 | 0.226 425 34 | 1010 1754 | 1303 6840 | 565 1195 |
| | 15 | -0.828 046 77 | +0.508 904 08 | +0.220 739 93 | -984 9497 | -1319 3594 | -571 9294 |

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of $10^{-9}$ a.u. per day

**FRAME BIAS, PRECESSION AND NUTATION, 2021**
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

| Date $0^h$ TT | | $M_{11}$ - 1 | $M_{12}$ | $M_{13}$ | $M_{21}$ | $M_{22}$ - 1 | $M_{23}$ | $M_{31}$ | $M_{32}$ | $M_{33}$ - 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Jan. | 0 | -1270 | -462 313 | -200 870 | +462 312 | -1069 | -1049 | +200 873 | +0121 | -202 |
| | 1 | 1271 | 462 430 | 200 921 | 462 429 | 1069 | 1072 | 200 924 | 0143 | 202 |
| | 2 | 1272 | 462 530 | 200 965 | 462 529 | 1070 | 1101 | 200 968 | 0172 | 202 |
| | 3 | 1272 | 462 609 | 200 999 | 462 608 | 1070 | 1133 | 201 002 | 0203 | 202 |
| | 4 | 1272 | 462 666 | 201 023 | 462 664 | 1070 | 1163 | 201 027 | 0233 | 202 |
| | 5 | 1273 | 462 705 | 201 041 | 462 704 | 1070 | 1185 | 201 044 | 0255 | 202 |
| | 6 | -1273 | -462 738 | -201 055 | +462 736 | -1071 | -1196 | +201 058 | +0266 | -202 |
| | 7 | 1273 | 462 775 | 201 071 | 462 773 | 1071 | 1196 | 201 074 | 0266 | 202 |
| | 8 | 1273 | 462 829 | 201 094 | 462 828 | 1071 | 1186 | 201 098 | 0255 | 202 |
| | 9 | 1274 | 462 909 | 201 129 | 462 907 | 1071 | 1171 | 201 132 | 0240 | 202 |
| | 10 | 1274 | 463 016 | 201 176 | 463 015 | 1072 | 1157 | 201 179 | 0226 | 202 |
| | 11 | 1275 | 463 146 | 201 232 | 463 144 | 1073 | 1151 | 201 235 | 0219 | 202 |
| | 12 | -1276 | -463 285 | -201 292 | +463 284 | -1073 | -1157 | +201 296 | +0224 | -203 |
| | 13 | 1277 | 463 420 | 201 351 | 463 419 | 1074 | 1176 | 201 354 | 0243 | 203 |
| | 14 | 1277 | 463 539 | 201 402 | 463 537 | 1074 | 1205 | 201 406 | 0271 | 203 |
| | 15 | 1278 | 463 632 | 201 443 | 463 631 | 1075 | 1240 | 201 447 | 0306 | 203 |
| | 16 | 1278 | 463 701 | 201 473 | 463 699 | 1075 | 1275 | 201 476 | 0340 | 203 |
| | 17 | 1278 | 463 747 | 201 493 | 463 746 | 1075 | 1305 | 201 497 | 0371 | 203 |
| | 18 | -1278 | -463 780 | -201 507 | +463 778 | -1075 | -1328 | +201 511 | +0393 | -203 |
| | 19 | 1279 | 463 806 | 201 519 | 463 805 | 1076 | 1342 | 201 523 | 0408 | 0203 |
| | 20 | 1279 | 463 835 | 201 531 | 463 833 | 1076 | 1348 | 201 535 | 0413 | 0203 |
| | 21 | 1279 | 463 872 | 201 547 | 463 870 | 1076 | 1347 | 201 551 | 0412 | 0203 |
| | 22 | 1279 | 463 923 | 201 569 | 463 921 | 1076 | 1342 | 201 573 | 0407 | 0203 |
| | 23 | 1280 | 463 990 | 201 598 | 463 988 | 1076 | 1335 | 201 602 | 0399 | 0203 |
| | 24 | -1280 | -464 074 | -201 635 | +464 072 | -1077 | -1329 | +201 639 | +0393 | -203 |
| | 25 | 1281 | 464 173 | 201 678 | 464 171 | 1077 | 1328 | 201 682 | 0392 | 203 |
| | 26 | 1281 | 464 283 | 201 726 | 464 281 | 1078 | 1335 | 201 730 | 0398 | 203 |
| | 27 | 1282 | 464 396 | 201 775 | 464 394 | 1078 | 1351 | 201 779 | 0414 | 204 |
| | 28 | 1282 | 464 504 | 201 822 | 464 502 | 1079 | 1377 | 201 826 | 0439 | 204 |
| | 29 | 1283 | 464 596 | 201 862 | 464 594 | 1079 | 1411 | 201 866 | 0473 | 204 |
| | 30 | -1283 | -464 667 | -201 893 | +464 665 | -1080 | -1449 | +201 897 | +0511 | -204 |
| | 31 | 1284 | 464 714 | 201 913 | 464 712 | 1080 | 1486 | 201 918 | 0547 | 204 |
| Feb. | 1 | 1284 | 464 741 | 201 925 | 464 739 | 1080 | 1516 | 201 930 | 0577 | 204 |
| | 2 | 1284 | 464 757 | 201 932 | 464 755 | 1080 | 1535 | 201 937 | 0596 | 204 |
| | 3 | 1284 | 464 775 | 201 940 | 464 773 | 1080 | 1541 | 201 944 | 0603 | 204 |
| | 4 | 1284 | 464 807 | 201 954 | 464 805 | 1080 | 1537 | 201 959 | 0598 | 204 |
| | 5 | -1284 | -464 863 | -201 978 | +464 861 | -1080 | -1526 | +201 983 | +0587 | -204 |
| | 6 | 1285 | 464 944 | 202 013 | 464 942 | 1081 | 1516 | 202 018 | 0576 | 204 |
| | 7 | 1285 | 465 048 | 202 058 | 465 045 | 1081 | 1511 | 202 063 | 0571 | 204 |
| | 8 | 1286 | 465 163 | 202 108 | 465 161 | 1082 | 1516 | 202 113 | 0576 | 204 |
| | 9 | 1287 | 465 279 | 202 158 | 465 277 | 1082 | 1533 | 202 163 | 0593 | 204 |
| | 10 | 1287 | 465 382 | 202 203 | 465 380 | 1083 | 1561 | 202 208 | 0620 | 204 |
| | 11 | -1288 | -465 465 | -202 239 | +465 462 | -1083 | -1596 | +202 244 | +0655 | -205 |
| | 12 | 1288 | 465 522 | 202 264 | 465 520 | 1084 | 1633 | 202 269 | 0691 | 205 |
| | 13 | 1288 | 465 556 | 202 279 | 465 554 | 1084 | 1666 | 202 284 | 0725 | 205 |
| | 14 | 1288 | 465 573 | 202 286 | 465 571 | 1084 | 1693 | 202 292 | 0751 | 205 |
| | 15 | -1288 | -465 581 | -202 290 | +465 579 | -1084 | -1711 | +202 296 | +0770 | -205 |

Values are in units of $10^{-8}$

**POSITION AND VELOCITY OF THE EARTH, 2021**
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

| Date $0^h$ T.D.B. | | X | Y | Z | $\dot{X}$ | $\dot{Y}$ | $\dot{Z}$ |
|---|---|---|---|---|---|---|---|
| Feb. | 15 | -0.828 046 77 | +0.508 904 08 | +0.220 739 93 | -984 9497 | -1319 3594 | -571 9294 |
| | 16 | 0.837 768 96 | 0.495 633 96 | 0.214 987 39 | 959 4412 | 1334 5909 | 578 5460 |
| | 17 | 0.847 234 70 | 0.482 213 75 | 0.209 169 66 | 933 6644 | 1349 3770 | 584 9677 |
| | 18 | 0.856 441 40 | 0.468 647 91 | 0.203 288 69 | 907 6327 | 1363 7165 | 591 1937 |
| | 19 | 0.865 386 55 | 0.454 940 91 | 0.197 346 44 | 881 3589 | 1377 6089 | 597 2235 |
| | 20 | 0.874 067 81 | 0.441 097 22 | 0.191 344 88 | 854 8556 | 1391 0538 | 603 0566 |
| | 21 | -0.882 482 94 | +0.427 121 32 | +0.185 285 97 | -828 1346 | -1404 0517 | -608 6930 |
| | 22 | 0.890 629 82 | 0.413 017 67 | 0.179 171 67 | 801 2083 | 1416 6035 | 614 1329 |
| | 23 | 0.898 506 46 | 0.398 790 73 | 0.173 003 96 | 774 0879 | 1428 7113 | 619 3771 |
| | 24 | 0.906 110 97 | 0.384 444 92 | 0.166 784 78 | 746 7844 | 1440 3781 | 624 4269 |
| | 25 | 0.913 441 57 | 0.369 984 62 | 0.160 516 06 | 719 3074 | 1451 6081 | 629 2842 |
| | 26 | 0.920 496 56 | 0.355 414 19 | 0.154 199 73 | 691 6643 | 1462 4066 | 633 9518 |
| | 27 | -0.927 274 31 | +0.340 737 91 | +0.147 837 65 | -663 8598 | -1472 7792 | -638 4326 |
| | 28 | 0.933 773 22 | 0.325 960 01 | 0.141 431 69 | 635 8957 | 1482 7303 | 642 7295 |
| Mar. | 1 | 0.939 991 69 | 0.311 084 70 | 0.134 983 66 | 607 7706 | 1492 2629 | 646 8449 |
| | 2 | 0.945 928 09 | 0.296 116 15 | 0.128 495 39 | 579 4812 | 1501 3764 | 650 7798 |
| | 3 | 0.951 580 76 | 0.281 058 58 | 0.121 968 67 | 551 0243 | 1510 0667 | 654 5336 |
| | 4 | 0.956 948 01 | 0.265 916 26 | 0.115 405 33 | 522 3973 | 1518 3263 | 658 1039 |
| | 5 | -0.962 028 14 | +0.250 693 53 | +0.108 807 22 | -493 6007 | -1526 1454 | -661 4871 |
| | 6 | 0.966 819 47 | 0.235 394 85 | 0.102 176 23 | 464 6378 | 1533 5125 | 664 6786 |
| | 7 | 0.971 320 36 | 0.220 024 82 | 0.095 514 30 | 435 5153 | 1540 4161 | 667 6732 |
| | 8 | 0.975 529 27 | 0.204 588 11 | 0.088 823 44 | 406 2428 | 1546 8452 | 670 4660 |
| | 9 | 0.979 444 76 | 0.189 089 53 | 0.082 105 67 | 376 8324 | 1552 7900 | 673 0523 |
| | 10 | 0.983 065 51 | 0.173 533 96 | 0.075 363 09 | 347 2980 | 1558 2422 | 675 4276 |
| | 11 | -0.986 390 36 | +0.157 926 35 | +0.068 597 83 | -317 6552 | -1563 1951 | -677 5884 |
| | 12 | 0.989 418 30 | 0.142 271 73 | 0.061 812 05 | 287 9205 | 1567 6443 | 679 5319 |
| | 13 | 0.992 148 51 | 0.126 575 16 | 0.055 007 93 | 258 1104 | 1571 5870 | 681 2562 |
| | 14 | 0.994 580 32 | 0.110 841 69 | 0.048 187 66 | 228 2417 | 1575 0222 | 682 7601 |
| | 15 | 0.996 713 21 | 0.095 076 40 | 0.041 353 46 | 198 3309 | 1577 9505 | 684 0433 |
| | 16 | 0.998 546 85 | 0.079 284 36 | 0.034 507 53 | 168 3935 | 1580 3741 | 685 1060 |
| | 17 | -1.000 081 04 | +0.063 470 59 | +0.027 652 07 | -138 4440 | -1582 2957 | -685 9490 |
| | 18 | 1.001 315 73 | 0.047 640 11 | 0.020 789 28 | 108 4965 | 1583 7191 | 686 5736 |
| | 19 | 1.002 251 02 | 0.031 797 86 | 0.013 921 32 | 78 5639 | 1584 6485 | 686 9814 |
| | 20 | 1.002 887 10 | 0.015 948 77 | 0.007 050 37 | 48 6585 | 1585 0886 | 687 1742 |
| | 21 | 1.003 224 32 | +0.000 097 70 | +0.000 178 55 | -18 7924 | 1585 0443 | 687 1541 |
| | 22 | 1.003 263 12 | -0.015 750 52 | -0.006 692 02 | +11 0232 | 1584 5212 | 686 9234 |
| | 23 | -1.003 004 06 | -0.031 591 15 | -0.013 559 23 | +40 7772 | -1583 5261 | -686 4847 |
| | 24 | 1.002 447 81 | 0.047 419 50 | 0.020 421 03 | 70 4598 | 1582 0661 | 685 8416 |
| | 25 | 1.001 595 13 | 0.063 230 95 | 0.027 275 39 | 100 0621 | 1580 1498 | 684 9981 |
| | 26 | 1.000 446 86 | 0.079 021 00 | 0.034 120 33 | 129 5775 | 1577 7864 | 683 9583 |
| | 27 | 0.999 003 88 | 0.094 785 22 | 0.040 953 92 | 159 0023 | 1574 9854 | 682 7273 |
| | 28 | 0.997 267 12 | 0.110 519 28 | 0.047 774 26 | 188 3361 | 1571 7559 | 681 3099 |
| | 29 | -0.995 237 45 | -0.126 218 93 | -0.054 579 51 | +217 5819 | -1568 1037 | -679 7102 |
| | 30 | 0.992 915 76 | 0.141 879 96 | 0.061 367 86 | 246 7445 | 1564 0319 | 677 9306 |
| | 31 | 0.990 302 82 | 0.157 498 16 | 0.068 137 52 | 275 8292 | 1559 5385 | 675 9715 |
| Apr. | 1 | 0.987 399 42 | 0.173 069 30 | 0.074 886 69 | 304 8390 | 1554 6179 | 673 8312 |
| | 2 | -0.984 206 30 | -0.188 589 07 | -0.081 613 53 | +333 7734 | -1549 2617 | -671 5066 |

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of $10^{-9}$ a.u. per day

**FRAME BIAS, PRECESSION AND NUTATION, 2021**
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

| Date $0^h$ TT | | $M_{11}$ - 1 | $M_{12}$ | $M_{13}$ | $M_{21}$ | $M_{22}$ - 1 | $M_{23}$ | $M_{31}$ | $M_{32}$ | $M_{33}$ - 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Feb. | 15 | -1288 | -465 581 | -202 290 | +465 579 | -1084 | -1711 | +202 296 | +0770 | -205 |
| | 16 | 1288 | 465 589 | 202 293 | 465 586 | 1084 | 1720 | 202 299 | 0779 | 205 |
| | 17 | 1289 | 465 602 | 202 299 | 465 600 | 1084 | 1721 | 202 305 | 0779 | 205 |
| | 18 | 1289 | 465 629 | 202 310 | 465 626 | 1084 | 1717 | 202 316 | 0775 | 205 |
| | 19 | 1289 | 465 671 | 202 329 | 465 668 | 1084 | 1709 | 202 334 | 0767 | 205 |
| | 20 | 1289 | 465 729 | 202 354 | 465 727 | 1085 | 1701 | 202 360 | 0759 | 205 |
| | 21 | -1290 | -465 804 | -202 386 | +465 801 | -1085 | -1697 | +202 392 | +0754 | -205 |
| | 22 | 1290 | 465 890 | 202 424 | 465 888 | 1085 | 1699 | 202 430 | 0756 | 205 |
| | 23 | 1291 | 465 983 | 202 464 | 465 981 | 1086 | 1710 | 202 470 | 0766 | 205 |
| | 24 | 1291 | 466 075 | 202 504 | 466 072 | 1086 | 1730 | 202 510 | 0786 | 205 |
| | 25 | 1292 | 466 155 | 202 539 | 466 153 | 1087 | 1759 | 202 545 | 0814 | 205 |
| | 26 | 1292 | 466 218 | 202 566 | 466 215 | 1087 | 1793 | 202 572 | 0849 | 205 |
| | 27 | -1292 | -466 256 | -202 583 | +466 253 | -1087 | -1829 | +202 589 | +0884 | -205 |
| | 28 | 1292 | 466 271 | 202 589 | 466 268 | 1087 | 1859 | 202 596 | 0914 | 205 |
| Mar. | 1 | 1292 | 466 271 | 202 590 | 466 268 | 1087 | 1879 | 202 596 | 0934 | 205 |
| | 2 | 1292 | 466 269 | 202 589 | 466 266 | 1087 | 1884 | 202 595 | 0940 | 205 |
| | 3 | 1292 | 466 279 | 202 593 | 466 276 | 1087 | 1878 | 202 600 | 0933 | 205 |
| | 4 | 1292 | 466 313 | 202 608 | 466 310 | 1087 | 1863 | 202 614 | 0918 | 205 |
| | 5 | -1293 | -466 374 | -202 634 | +466 371 | -1088 | -1846 | +202 641 | +0901 | -205 |
| | 6 | 1293 | 466 458 | 202 671 | 466 455 | 1088 | 1834 | 202 677 | 0888 | 205 |
| | 7 | 1294 | 466 557 | 202 714 | 466 554 | 1088 | 1831 | 202 720 | 0885 | 205 |
| | 8 | 1294 | 466 657 | 202 757 | 466 654 | 1089 | 1840 | 202 764 | 0894 | 206 |
| | 9 | 1295 | 466 748 | 202 797 | 466 745 | 1089 | 1859 | 202 803 | 0913 | 206 |
| | 10 | 1295 | 466 820 | 202 828 | 466 817 | 1090 | 1886 | 202 835 | 0939 | 206 |
| | 11 | -1296 | -466 869 | -202 849 | +466 866 | -1090 | -1916 | +202 856 | +0969 | -206 |
| | 12 | 1296 | 466 896 | 202 861 | 466 893 | 1090 | 1944 | 202 868 | 0997 | 206 |
| | 13 | 1296 | 466 904 | 202 865 | 466 901 | 1090 | 1966 | 202 872 | 1019 | 206 |
| | 14 | 1296 | 466 901 | 202 864 | 466 898 | 1090 | 1980 | 202 871 | 1033 | 206 |
| | 15 | 1296 | 466 896 | 202 861 | 466 893 | 1090 | 1985 | 202 868 | 1038 | 206 |
| | 16 | 1296 | 466 895 | 202 861 | 466 892 | 1090 | 1981 | 202 868 | 1033 | 206 |
| | 17 | -1296 | -466 906 | -202 866 | +466 903 | -1090 | -1970 | +202 873 | +1022 | -206 |
| | 18 | 1296 | 466 933 | 202 877 | 466 930 | 1090 | 1955 | 202 884 | 1007 | 206 |
| | 19 | 1296 | 466 976 | 202 896 | 466 973 | 1090 | 1939 | 202 903 | 0991 | 206 |
| | 20 | 1297 | 467 036 | 202 922 | 467 033 | 1091 | 1925 | 202 929 | 0977 | 206 |
| | 21 | 1297 | 467 110 | 202 954 | 467 107 | 1091 | 1917 | 202 961 | 0969 | 206 |
| | 22 | 1297 | 467 192 | 202 990 | 467 189 | 1091 | 1916 | 202 997 | 0968 | 206 |
| | 23 | -1298 | -467 275 | -203 026 | +467 272 | -1092 | -1924 | +203 033 | +0975 | -206 |
| | 24 | 1298 | 467 353 | 203 060 | 467 350 | 1092 | 1941 | 203 067 | 0992 | 206 |
| | 25 | 1299 | 467 416 | 203 087 | 467 413 | 1092 | 1965 | 203 094 | 1015 | 206 |
| | 26 | 1299 | 467 459 | 203 106 | 467 456 | 1093 | 1992 | 203 113 | 1042 | 206 |
| | 27 | 1299 | 467 479 | 203 115 | 467 475 | 1093 | 2016 | 203 122 | 1067 | 206 |
| | 28 | 1299 | 467 479 | 203 115 | 467 476 | 1093 | 2033 | 203 122 | 1083 | 206 |
| | 29 | -1299 | -467 472 | -203 112 | +467 469 | -1093 | -2036 | +203 119 | +1086 | -206 |
| | 30 | 1299 | 467 473 | 203 112 | 467 470 | 1093 | 2024 | 203 120 | 1075 | 206 |
| | 31 | 1299 | 467 497 | 203 123 | 467 494 | 1093 | 2001 | 203 130 | 1052 | 206 |
| Apr. | 1 | 1299 | 467 550 | 203 146 | 467 547 | 1093 | 1974 | 203 153 | 1024 | 206 |
| | 2 | -1300 | -467 631 | -203 181 | +467 628 | -1093 | -1950 | +203 188 | +1000 | -206 |

Values are in units of $10^{-8}$

**POSITION AND VELOCITY OF THE EARTH, 2021**
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

| Date $0^h$ T.D.B. | | X | Y | Z | $\dot{X}$ | $\dot{Y}$ | $\dot{Z}$ |
|---|---|---|---|---|---|---|---|
| Apr. | 1 | -0.987 399 42 | -0.173 069 30 | -0.074 886 69 | +304 8390 | -1554 6179 | -673 8312 |
| | 2 | 0.984 206 30 | 0.188 589 07 | 0.081 613 53 | 333 7734 | 1549 2617 | 671 5066 |
| | 3 | 0.980 724 22 | 0.204 053 06 | 0.088 316 20 | 362 6274 | 1543 4608 | 668 9938 |
| | 4 | 0.976 954 04 | 0.219 456 77 | 0.094 992 77 | 391 3924 | 1537 2069 | 666 2886 |
| | 5 | 0.972 896 71 | 0.234 795 66 | 0.101 641 31 | 420 0566 | 1530 4931 | 663 3875 |
| | 6 | 0.968 553 29 | 0.250 065 09 | 0.108 259 86 | 448 6063 | 1523 3148 | 660 2878 |
| | 7 | -0.963 925 01 | -0.265 260 40 | -0.114 846 40 | +477 0269 | -1515 6696 | -656 9876 |
| | 8 | 0.959 013 24 | 0.280 376 92 | 0.121 398 94 | 505 3031 | 1507 5569 | 653 4857 |
| | 9 | 0.953 819 48 | 0.295 409 98 | 0.127 915 44 | 533 4196 | 1498 9776 | 649 7820 |
| | 10 | 0.948 345 43 | 0.310 354 93 | 0.134 393 91 | 561 3613 | 1489 9341 | 645 8768 |
| | 11 | 0.942 592 89 | 0.325 207 13 | 0.140 832 31 | 589 1139 | 1480 4307 | 641 7710 |
| | 12 | 0.936 563 83 | 0.339 962 02 | 0.147 228 66 | 616 6630 | 1470 4722 | 637 4665 |
| | 13 | -0.930 260 35 | -0.354 615 08 | -0.153 580 99 | +643 9951 | -1460 0647 | -632 9653 |
| | 14 | 0.923 684 69 | 0.369 161 84 | 0.159 887 32 | 671 0977 | 1449 2152 | 628 2700 |
| | 15 | 0.916 839 20 | 0.383 597 93 | 0.166 145 75 | 697 9593 | 1437 9312 | 623 3836 |
| | 16 | 0.909 726 35 | 0.397 919 05 | 0.172 354 37 | 724 5686 | 1426 2210 | 618 3096 |
| | 17 | 0.902 348 70 | 0.412 120 96 | 0.178 511 33 | 750 9157 | 1414 0931 | 613 0516 |
| | 18 | 0.894 708 94 | 0.426 199 55 | 0.184 614 80 | 776 9912 | 1401 5565 | 607 6133 |
| | 19 | -0.886 809 81 | -0.440 150 76 | -0.190 663 01 | +802 7866 | -1388 6205 | -601 9988 |
| | 20 | 0.878 654 17 | 0.453 970 66 | 0.196 654 21 | 828 2938 | 1375 2955 | 0596 2128 |
| | 21 | 0.870 244 92 | 0.467 655 41 | 0.202 586 71 | 853 5060 | 1361 5918 | 0590 2598 |
| | 22 | 0.861 585 05 | 0.481 201 27 | 0.208 458 86 | 878 4178 | 1347 5209 | 0584 1454 |
| | 23 | 0.852 677 58 | 0.494 604 64 | 0.214 269 10 | 903 0257 | 1333 0949 | 0577 8754 |
| | 24 | 0.843 525 55 | 0.507 862 02 | 0.220 015 87 | 927 3291 | 1318 3256 | 0571 4556 |
| | 25 | -0.834 132 00 | -0.520 970 05 | -0.225 697 73 | +951 3303 | -1303 2240 | -0564 8919 |
| | 26 | 0.824 499 93 | 0.533 925 43 | 0.231 313 25 | 975 0350 | 1287 7985 | 558 1892 |
| | 27 | 0.814 632 27 | 0.546 724 95 | 0.236 861 06 | 998 4508 | 1272 0538 | 551 3511 |
| | 28 | 0.804 531 85 | 0.559 365 44 | 0.242 339 82 | 1021 5857 | 1255 9899 | 544 3784 |
| | 29 | 0.794 201 47 | 0.571 843 67 | 0.247 748 18 | 1044 4446 | 1239 6024 | 537 2701 |
| | 30 | 0.783 643 88 | 0.584 156 38 | 0.253 084 76 | 1067 0286 | 1222 8843 | 530 0235 |
| May | 1 | -0.772 861 83 | -0.596 300 23 | -0.258 348 17 | +1089 3334 | -1205 8278 | -522 6349 |
| | 2 | 0.761 858 17 | 0.608 271 79 | 0.263 536 97 | 1111 3505 | 1188 4271 | 515 1009 |
| | 3 | 0.750 635 82 | 0.620 067 61 | 0.268 649 70 | 1133 0680 | 1170 6784 | 507 4191 |
| | 4 | 0.739 197 85 | 0.631 684 20 | 0.273 684 86 | 1154 4727 | 1152 5810 | 499 5884 |
| | 5 | 0.727 547 45 | 0.643 118 08 | 0.278 640 97 | 1175 5510 | 1134 1368 | 491 6084 |
| | 6 | 0.715 687 96 | 0.654 365 79 | 0.283 516 53 | 1196 2899 | 1115 3493 | 483 4800 |
| | 7 | -0.703 622 83 | -0.665 423 94 | -0.288 310 08 | +1216 6764 | -1096 2240 | -475 2048 |
| | 8 | 0.691 355 65 | 0.676 289 16 | 0.293 020 15 | 1236 6986 | 1076 7672 | 466 7849 |
| | 9 | 0.678 890 11 | 0.686 958 20 | 0.297 645 30 | 1256 3454 | 1056 9863 | 458 2229 |
| | 10 | 0.666 230 02 | 0.697 427 84 | 0.302 184 14 | 1275 6062 | 1036 8895 | 449 5220 |
| | 11 | 0.653 379 31 | 0.707 694 97 | 0.306 635 29 | 1294 4709 | 1016 4857 | 440 6856 |
| | 12 | 0.640 341 96 | 0.717 756 56 | 0.310 997 41 | 1312 9307 | 995 7845 | 431 7176 |
| | 13 | -0.627 122 07 | -0.727 609 70 | -0.315 269 22 | +1330 9769 | -974 7957 | -422 6220 |
| | 14 | 0.613 723 82 | 0.737 251 55 | 0.319 449 44 | 1348 6020 | 953 5304 | 413 4033 |
| | 15 | 0.600 151 46 | 0.746 679 42 | 0.323 536 89 | 1365 7995 | 931 9995 | 404 0666 |
| | 16 | 0.586 409 28 | 0.755 890 70 | 0.327 530 40 | 1382 5636 | 910 2146 | 394 6166 |
| | 17 | -0.572 501 64 | -0.764 882 90 | -0.331 428 86 | +1398 8896 | -888 1874 | -385 0587 |

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of $10^{-9}$ a.u. per day

**FRAME BIAS, PRECESSION AND NUTATION, 2021**
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

| Date $0^h$ TT | | $M_{11}$ - 1 | $M_{12}$ | $M_{13}$ | $M_{21}$ | $M_{22}$ - 1 | $M_{23}$ | $M_{31}$ | $M_{32}$ | $M_{33}$ - 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Apr. | 1 | -1299 | -467 550 | -203 146 | +467 547 | -1093 | -1974 | +203 153 | +1024 | -206 |
| | 2 | 1300 | 467 631 | 203 181 | 467 628 | 1093 | 1950 | 203 188 | 1000 | 206 |
| | 3 | 1300 | 467 731 | 203 225 | 467 729 | 1094 | 1936 | 203 231 | 0985 | 207 |
| | 4 | 1301 | 467 837 | 203 270 | 467 834 | 1094 | 1933 | 203 277 | 0982 | 207 |
| | 5 | 1301 | 467 934 | 203 312 | 467 931 | 1095 | 1942 | 203 319 | 0990 | 207 |
| | 6 | 1302 | 468 013 | 203 347 | 468 010 | 1095 | 1959 | 203 354 | 1007 | 207 |
| | 7 | -1302 | -468 070 | -203 371 | +468 067 | -1095 | -1980 | +203 378 | +1028 | -207 |
| | 8 | 1302 | 468 104 | 203 386 | 468 101 | 1096 | 2000 | 203 393 | 1048 | 207 |
| | 9 | 1303 | 468 119 | 203 393 | 468 116 | 1096 | 2016 | 203 400 | 1063 | 207 |
| | 10 | 1303 | 468 123 | 203 395 | 468 119 | 1096 | 2023 | 203 402 | 1071 | 207 |
| | 11 | 1303 | 468 122 | 203 394 | 468 118 | 1096 | 2022 | 203 401 | 1070 | 207 |
| | 12 | 1303 | 468 124 | 203 395 | 468 121 | 1096 | 2012 | 203 402 | 1059 | 207 |
| | 13 | -1303 | -468 137 | -203 401 | +468 134 | -1096 | -1994 | +203 408 | +1042 | -207 |
| | 14 | 1303 | 468 165 | 203 413 | 468 162 | 1096 | 1972 | 203 420 | 1020 | 207 |
| | 15 | 1303 | 468 211 | 203 433 | 468 208 | 1096 | 1948 | 203 440 | 0996 | 207 |
| | 16 | 1303 | 468 274 | 203 460 | 468 271 | 1096 | 1926 | 203 467 | 0973 | 207 |
| | 17 | 1304 | 468 351 | 203 494 | 468 348 | 1097 | 1908 | 203 501 | 0955 | 207 |
| | 18 | 1304 | 468 439 | 203 532 | 468 436 | 1097 | 1897 | 203 539 | 0944 | 207 |
| | 19 | -1305 | -468 530 | -203 572 | +468 527 | -1098 | -1895 | +203 578 | +0941 | -207 |
| | 20 | 1305 | 468 618 | 203 610 | 468 615 | 1098 | 1902 | 203 617 | 0948 | 207 |
| | 21 | 1306 | 468 695 | 203 643 | 468 692 | 1098 | 1916 | 203 650 | 0961 | 207 |
| | 22 | 1306 | 468 755 | 203 669 | 468 752 | 1099 | 1935 | 203 676 | 0980 | 207 |
| | 23 | 1306 | 468 794 | 203 686 | 468 791 | 1099 | 1954 | 203 693 | 0999 | 207 |
| | 24 | 1306 | 468 813 | 203 695 | 468 810 | 1099 | 1968 | 203 702 | 1013 | 207 |
| | 25 | -1306 | -468 820 | -203 698 | +468 817 | -1099 | -1971 | +203 705 | +1016 | -207 |
| | 26 | 1306 | 468 828 | 203 701 | 468 825 | 1099 | 1960 | 203 708 | 1005 | 207 |
| | 27 | 1307 | 468 852 | 203 712 | 468 849 | 1099 | 1935 | 203 719 | 0980 | 208 |
| | 28 | 1307 | 468 907 | 203 736 | 468 904 | 1099 | 1903 | 203 742 | 0947 | 208 |
| | 29 | 1307 | 468 994 | 203 774 | 468 991 | 1100 | 1870 | 203 780 | 0914 | 208 |
| | 30 | 1308 | 469 108 | 203 823 | 469 105 | 1100 | 1845 | 203 829 | 0889 | 208 |
| May | 1 | -1309 | -469 233 | -203 877 | +469 230 | -1101 | -1834 | +203 884 | +0877 | -208 |
| | 2 | 1309 | 469 354 | 203 930 | 469 351 | 1101 | 1835 | 203 936 | 0878 | 208 |
| | 3 | 1310 | 469 458 | 203 975 | 469 455 | 1102 | 1847 | 203 981 | 0890 | 208 |
| | 4 | 1310 | 469 538 | 204 009 | 469 535 | 1102 | 1865 | 204 016 | 0907 | 208 |
| | 5 | 1311 | 469 593 | 204 034 | 469 591 | 1103 | 1883 | 204 040 | 0925 | 208 |
| | 6 | 1311 | 469 629 | 204 049 | 469 626 | 1103 | 1896 | 204 056 | 0938 | 208 |
| | 7 | -1311 | -469 650 | -204 058 | +469 647 | -1103 | -1903 | +204 065 | +0945 | -208 |
| | 8 | 1311 | 469 665 | 204 065 | 469 662 | 1103 | 1901 | 204 072 | 0943 | 208 |
| | 9 | 1311 | 469 682 | 204 072 | 469 679 | 1103 | 1890 | 204 079 | 0932 | 208 |
| | 10 | 1311 | 469 708 | 204 084 | 469 706 | 1103 | 1872 | 204 090 | 0914 | 208 |
| | 11 | 1312 | 469 749 | 204 101 | 469 746 | 1103 | 1849 | 204 108 | 0890 | 208 |
| | 12 | 1312 | 469 806 | 204 126 | 469 804 | 1104 | 1823 | 204 133 | 0864 | 208 |
| | 13 | -1312 | -469 882 | -204 159 | +469 879 | -1104 | -1799 | +204 165 | +0839 | -208 |
| | 14 | 1313 | 469 973 | 204 199 | 469 970 | 1104 | 1778 | 204 205 | 0819 | 209 |
| | 15 | 1313 | 470 075 | 204 243 | 470 072 | 1105 | 1765 | 204 249 | 0805 | 209 |
| | 16 | 1314 | 470 182 | 204 289 | 470 180 | 1105 | 1760 | 204 295 | 0799 | 209 |
| | 17 | -1315 | -470 287 | -204 335 | +470 285 | -1106 | -1763 | +204 341 | +0802 | -209 |

Values are in units of $10^{-8}$

**POSITION AND VELOCITY OF THE EARTH, 2021**
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

| Date $0^h$ T.D.B. | | X | Y | Z | $\dot{X}$ | $\dot{Y}$ | $\dot{Z}$ |
|---|---|---|---|---|---|---|---|
| May | 17 | -0.572 501 64 | -0.764 882 90 | -0.331 428 86 | +1398 8896 | -888 1874 | -385 0587 |
| | 18 | 0.558 432 96 | 0.773 653 68 | 0.335 231 23 | 1414 7738 | 865 9303 | 375 3985 |
| | 19 | 0.544 207 65 | 0.782 200 78 | 0.338 936 51 | 1430 2139 | 843 4557 | 365 6418 |
| | 20 | 0.529 830 16 | 0.790 522 11 | 0.342 543 76 | 1445 2089 | 820 7763 | 355 7943 |
| | 21 | 0.515 304 95 | 0.798 615 67 | 0.346 052 12 | 1459 7597 | 797 9050 | 345 8626 |
| | 22 | 0.500 636 44 | 0.806 479 61 | 0.349 460 76 | 1473 8698 | 774 8540 | 335 8530 |
| | 23 | -0.485 829 00 | -0.814 112 19 | -0.352 768 94 | +1487 5454 | -751 6345 | -325 7710 |
| | 24 | 0.470 886 95 | 0.821 511 77 | 0.355 975 95 | 1500 7948 | 728 2549 | 315 6217 |
| | 25 | 0.455 814 49 | 0.828 676 77 | 0.359 081 16 | 1513 6285 | 704 7201 | 305 4086 |
| | 26 | 0.440 615 73 | 0.835 605 65 | 0.362 083 92 | 1526 0563 | 681 0308 | 295 1328 |
| | 27 | 0.425 294 70 | 0.842 296 86 | 0.364 983 60 | 1538 0856 | 657 1832 | 284 7934 |
| | 28 | 0.409 855 34 | 0.848 748 77 | 0.367 779 56 | 1549 7193 | 633 1710 | 274 3877 |
| | 29 | -0.394 301 64 | -0.854 959 71 | -0.370 471 12 | +1560 9547 | -608 9877 | -263 9123 |
| | 30 | 0.378 637 60 | 0.860 927 94 | 0.373 057 57 | 1571 7849 | 584 6286 | 253 3644 |
| | 31 | 0.362 867 32 | 0.866 651 69 | 0.375 538 16 | 1582 1992 | 560 0919 | 242 7422 |
| June | 1 | 0.346 995 04 | 0.872 129 19 | 0.377 912 16 | 1592 1864 | 535 3793 | 232 0453 |
| | 2 | 0.331 025 06 | 0.877 358 70 | 0.380 178 82 | 1601 7348 | 510 4950 | 221 2744 |
| | 3 | 0.314 961 84 | 0.882 338 54 | 0.382 337 41 | 1610 8338 | 485 4455 | 210 4317 |
| | 4 | -0.298 809 91 | -0.887 067 09 | -0.384 387 22 | +1619 4740 | -460 2388 | -199 5199 |
| | 5 | 0.282 573 91 | 0.891 542 82 | 0.386 327 59 | 1627 6470 | 434 8836 | 188 5421 |
| | 6 | 0.266 258 55 | 0.895 764 29 | 0.388 157 86 | 1635 3454 | 409 3894 | 177 5020 |
| | 7 | 0.249 868 61 | 0.899 730 17 | 0.389 877 43 | 1642 5623 | 383 7659 | 166 4036 |
| | 8 | 0.233 408 93 | 0.903 439 22 | 0.391 485 75 | 1649 2920 | 358 0235 | 155 2510 |
| | 9 | 0.216 884 41 | 0.906 890 28 | 0.392 982 29 | 1655 5289 | 332 1728 | 144 0485 |
| | 10 | -0.200 300 01 | -0.910 082 35 | -0.394 366 57 | +1661 2686 | -306 2255 | -132 8012 |
| | 11 | 0.183 660 71 | 0.913 014 51 | 0.395 638 18 | 1666 5071 | 280 1933 | 121 5138 |
| | 12 | 0.166 971 55 | 0.915 685 97 | 0.396 796 73 | 1671 2416 | 254 0884 | 110 1918 |
| | 13 | 0.150 237 57 | 0.918 096 08 | 0.397 841 92 | 1675 4702 | 227 9237 | 98 8410 |
| | 14 | 0.133 463 83 | 0.920 244 29 | 0.398 773 48 | 1679 1927 | 201 7120 | 87 4671 |
| | 15 | 0.116 655 40 | 0.922 130 21 | 0.399 591 20 | 1682 4100 | 175 4665 | 76 0761 |
| | 16 | -0.099 817 31 | -0.923 753 55 | -0.400 294 96 | +1685 1243 | -149 2002 | -64 6744 |
| | 17 | 0.082 954 58 | 0.925 114 18 | 0.400 884 68 | 1687 3398 | 122 9255 | 53 2681 |
| | 18 | 0.066 072 16 | 0.926 212 08 | 0.401 360 33 | 1689 0622 | 96 6549 | 41 8630 |
| | 19 | 0.049 174 95 | 0.927 047 33 | 0.401 721 96 | 1690 2995 | 70 3991 | 30 4650 |
| | 20 | 0.032 267 75 | 0.927 620 14 | 0.401 969 67 | 1691 0616 | 44 1676 | 19 0791 |
| | 21 | -0.015 355 26 | 0.927 930 79 | 0.402 103 60 | 1691 3595 | -17 9671 | -7 7094 |
| | 22 | +0.001 557 93 | -0.927 979 60 | -0.402 123 92 | +1691 2055 | +8 1988 | +3 6416 |
| | 23 | 0.018 467 38 | 0.927 766 92 | 0.402 030 83 | 1690 6108 | 34 3304 | 14 9732 |
| | 24 | 0.035 368 71 | 0.927 293 09 | 0.401 824 51 | 1689 5841 | 60 4313 | 26 2867 |
| | 25 | 0.052 257 63 | 0.926 558 38 | 0.401 505 15 | 1688 1297 | 86 5073 | 37 5845 |
| | 26 | 0.069 129 88 | 0.925 563 01 | 0.401 072 87 | 1686 2469 | 112 5639 | 48 8697 |
| | 27 | 0.085 981 13 | 0.924 307 15 | 0.400 527 78 | 1683 9307 | 138 6052 | 60 1452 |
| | 28 | +0.102 807 02 | -0.922 790 96 | -0.399 869 99 | +1681 1729 | +164 6321 | +71 4121 |
| | 29 | 0.119 603 08 | 0.921 014 57 | 0.399 099 57 | 1677 9646 | 190 6418 | 82 6707 |
| | 30 | 0.136 364 78 | 0.918 978 19 | 0.398 216 61 | 1674 2969 | 216 6288 | 93 9196 |
| July | 1 | 0.153 087 46 | 0.916 682 09 | 0.397 221 22 | 1670 1620 | 242 5855 | 105 1561 |
| | 2 | +0.169 766 44 | -0.914 126 61 | -0.396 113 54 | +1665 5538 | +268 5029 | +116 3770 |

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of $10^{-9}$ a.u. per day

**FRAME BIAS, PRECESSION AND NUTATION, 2021**
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

| Date $0^h$ TT | | $M_{11}$ - 1 | $M_{12}$ | $M_{13}$ | $M_{21}$ | $M_{22}$ - 1 | $M_{23}$ | $M_{31}$ | $M_{32}$ | $M_{33}$ - 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| May | 17 | -1315 | -470 287 | -204 335 | +470 285 | -1106 | -1763 | +204 341 | +0802 | -209 |
| | 18 | 1315 | 470 383 | 204 377 | 470 381 | 1106 | 1775 | 204 383 | 0813 | 209 |
| | 19 | 1316 | 470 464 | 204 412 | 470 461 | 1107 | 1792 | 204 418 | 0830 | 209 |
| | 20 | 1316 | 470 525 | 204 439 | 470 523 | 1107 | 1811 | 204 445 | 0849 | 209 |
| | 21 | 1316 | 470 567 | 204 457 | 470 565 | 1107 | 1827 | 204 463 | 0865 | 209 |
| | 22 | 1316 | 470 595 | 204 469 | 470 592 | 1107 | 1835 | 204 475 | 0873 | 209 |
| | 23 | -1316 | -470 617 | -204 478 | +470 614 | -1107 | -1831 | +204 485 | +0869 | -209 |
| | 24 | 1317 | 470 649 | 204 492 | 470 647 | 1108 | 1814 | 204 499 | 0851 | 209 |
| | 25 | 1317 | 470 705 | 204 517 | 470 703 | 1108 | 1786 | 204 523 | 0823 | 209 |
| | 26 | 1317 | 470 794 | 204 555 | 470 792 | 1108 | 1754 | 204 561 | 0791 | 209 |
| | 27 | 1318 | 470 915 | 204 608 | 470 913 | 1109 | 1727 | 204 614 | 0764 | 209 |
| | 28 | 1319 | 471 057 | 204 669 | 471 055 | 1109 | 1712 | 204 675 | 0748 | 209 |
| | 29 | -1320 | -471 202 | -204 732 | +471 200 | -1110 | -1711 | +204 738 | +0746 | -210 |
| | 30 | 1320 | 471 334 | 204 789 | 471 331 | 1111 | 1724 | 204 795 | 0758 | 210 |
| | 31 | 1321 | 471 441 | 204 836 | 471 439 | 1111 | 1744 | 204 842 | 0779 | 210 |
| June | 1 | 1322 | 471 522 | 204 871 | 471 519 | 1112 | 1768 | 204 877 | 0802 | 210 |
| | 2 | 1322 | 471 578 | 204 896 | 471 576 | 1112 | 1788 | 204 902 | 0821 | 210 |
| | 3 | 1322 | 471 617 | 204 913 | 471 615 | 1112 | 1801 | 204 919 | 0835 | 210 |
| | 4 | -1322 | -471 648 | -204 926 | +471 645 | -1112 | -1806 | +204 932 | +0839 | -210 |
| | 5 | 1322 | 471 678 | 204 939 | 471 675 | 1112 | 1802 | 204 945 | 0835 | 210 |
| | 6 | 1323 | 471 715 | 204 955 | 471 712 | 1113 | 1790 | 204 961 | 0823 | 210 |
| | 7 | 1323 | 471 764 | 204 977 | 471 762 | 1113 | 1773 | 204 983 | 0806 | 210 |
| | 8 | 1323 | 471 831 | 205 005 | 471 828 | 1113 | 1752 | 205 011 | 0785 | 210 |
| | 9 | 1324 | 471 914 | 205 042 | 471 912 | 1114 | 1733 | 205 048 | 0765 | 210 |
| | 10 | -1324 | -472 014 | -205 085 | +472 012 | -1114 | -1716 | +205 091 | +0748 | -210 |
| | 11 | 1325 | 472 126 | 205 134 | 472 124 | 1115 | 1707 | 205 140 | 0738 | 210 |
| | 12 | 1326 | 472 245 | 205 185 | 472 242 | 1115 | 1705 | 205 191 | 0736 | 211 |
| | 13 | 1326 | 472 362 | 205 236 | 472 360 | 1116 | 1713 | 205 242 | 0743 | 211 |
| | 14 | 1327 | 472 471 | 205 283 | 472 469 | 1116 | 1729 | 205 289 | 0759 | 211 |
| | 15 | 1327 | 472 565 | 205 324 | 472 563 | 1117 | 1751 | 205 330 | 0781 | 211 |
| | 16 | -1328 | -472 640 | -205 357 | +472 638 | -1117 | -1776 | +205 363 | +0805 | -211 |
| | 17 | 1328 | 472 696 | 205 381 | 472 693 | 1117 | 1799 | 205 387 | 0828 | 211 |
| | 18 | 1328 | 472 735 | 205 398 | 472 732 | 1117 | 1816 | 205 404 | 0845 | 211 |
| | 19 | 1329 | 472 766 | 205 412 | 472 764 | 1118 | 1823 | 205 418 | 0852 | 211 |
| | 20 | 1329 | 472 801 | 205 427 | 472 799 | 1118 | 1817 | 205 433 | 0846 | 211 |
| | 21 | 1329 | 472 854 | 205 450 | 472 851 | 1118 | 1801 | 205 456 | 0829 | 211 |
| | 22 | -1329 | -472 934 | -205 485 | +472 931 | -1118 | -1778 | +205 491 | +0806 | -211 |
| | 23 | 1330 | 473 046 | 205 533 | 473 044 | 1119 | 1756 | 205 539 | 0784 | 211 |
| | 24 | 1331 | 473 185 | 205 594 | 473 183 | 1120 | 1743 | 205 600 | 0770 | 211 |
| | 25 | 1332 | 473 337 | 205 659 | 473 334 | 1120 | 1743 | 205 665 | 0769 | 211 |
| | 26 | 1333 | 473 482 | 205 722 | 473 480 | 1121 | 1758 | 205 728 | 0784 | 212 |
| | 27 | 1333 | 473 608 | 205 777 | 473 605 | 1122 | 1784 | 205 783 | 0810 | 212 |
| | 28 | -1334 | -473 705 | -205 819 | +473 702 | -1122 | -1816 | +205 825 | +0841 | -212 |
| | 29 | 1334 | 473 774 | 205 849 | 473 771 | 1122 | 1847 | 205 855 | 0871 | 212 |
| | 30 | 1334 | 473 821 | 205 869 | 473 818 | 1123 | 1871 | 205 876 | 0896 | 212 |
| July | 1 | 1335 | 473 855 | 205 884 | 473 852 | 1123 | 1887 | 205 891 | 0912 | 212 |
| | 2 | -1335 | -473 886 | -205 898 | +473 883 | -1123 | -1894 | +205 904 | +0918 | -212 |

Values are in units of $10^{-8}$

**POSITION AND VELOCITY OF THE EARTH, 2021**
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

| Date $0^h$ T.D.B. | | X | Y | Z | $\dot{X}$ | $\dot{Y}$ | $\dot{Z}$ |
|---|---|---|---|---|---|---|---|
| July | 1 | +0.153 087 46 | -0.916 682 09 | -0.397 221 22 | +1670 1620 | +242 5855 | +105 1561 |
| | 2 | 0.169 766 44 | 0.914 126 61 | 0.396 113 54 | 1665 5538 | 268 5029 | 116 3770 |
| | 3 | 0.186 396 95 | 0.911 312 20 | 0.394 893 74 | 1660 4672 | 294 3712 | 127 5786 |
| | 4 | 0.202 974 18 | 0.908 239 39 | 0.393 562 04 | 1654 8988 | 320 1802 | 138 7569 |
| | 5 | 0.219 493 31 | 0.904 908 83 | 0.392 118 70 | 1648 8456 | 345 9197 | 149 9077 |
| | 6 | 0.235 949 47 | 0.901 321 26 | 0.390 564 00 | 1642 3055 | 371 5789 | 161 0265 |
| | 7 | +0.252 337 79 | -0.897 477 55 | -0.388 898 29 | +1635 2767 | +397 1470 | +172 1088 |
| | 8 | 0.268 653 37 | 0.893 378 66 | 0.387 121 96 | 1627 7583 | 422 6125 | 183 1497 |
| | 9 | 0.284 891 32 | 0.889 025 68 | 0.385 235 45 | 1619 7502 | 447 9634 | 194 1441 |
| | 10 | 0.301 046 74 | 0.884 419 82 | 0.383 239 25 | 1611 2533 | 473 1875 | 205 0865 |
| | 11 | 0.317 114 76 | 0.879 562 40 | 0.381 133 91 | 1602 2694 | 498 2719 | 215 9710 |
| | 12 | 0.333 090 52 | 0.874 454 89 | 0.378 920 04 | 1592 8025 | 523 2035 | 226 7917 |
| | 13 | +0.348 969 22 | -0.869 098 88 | -0.376 598 31 | +1582 8579 | +547 9694 | +237 5425 |
| | 14 | 0.364 746 11 | 0.863 496 09 | 0.374 169 45 | 1572 4429 | 572 5573 | 248 2172 |
| | 15 | 0.380 416 54 | 0.857 648 37 | 0.371 634 24 | 1561 5664 | 596 9557 | 258 8102 |
| | 16 | 0.395 975 94 | 0.851 557 65 | 0.368 993 53 | 1550 2392 | 621 1546 | 269 3161 |
| | 17 | 0.411 419 86 | 0.845 225 97 | 0.366 248 22 | 1538 4733 | 645 1455 | 279 7307 |
| | 18 | 0.426 743 99 | 0.838 655 45 | 0.363 399 24 | 1526 2822 | 668 9222 | 290 0497 |
| | 19 | +0.441 944 13 | -0.831 848 25 | -0.360 447 55 | +1513 6793 | +692 4812 | +300 2712 |
| | 20 | 0.457 016 24 | 0.824 806 56 | 0.357 394 14 | 1500 6779 | 715 8214 | 310 3938 |
| | 21 | 0.471 956 40 | 0.817 532 54 | 0.354 240 00 | 1487 2896 | 738 9451 | 320 4182 |
| | 22 | 0.486 760 78 | 0.810 028 36 | 0.350 986 10 | 1473 5234 | 761 8567 | 330 3460 |
| | 23 | 0.501 425 63 | 0.802 296 10 | 0.347 633 40 | 1459 3844 | 784 5614 | 340 1798 |
| | 24 | 0.515 947 22 | 0.794 337 80 | 0.344 182 81 | 1444 8733 | 807 0645 | 349 9228 |
| | 25 | +0.530 321 84 | -0.786 155 47 | -0.340 635 24 | +1429 9876 | +829 3692 | +359 5773 |
| | 26 | 0.544 545 71 | 0.777 751 08 | 0.336 991 55 | 1414 7218 | 0851 4762 | 369 1446 |
| | 27 | 0.558 614 99 | 0.769 126 62 | 0.333 252 63 | 1399 0698 | 0873 3827 | 378 6245 |
| | 28 | 0.572 525 80 | 0.760 284 11 | 0.329 419 36 | 1383 0260 | 0895 0832 | 388 0158 |
| | 29 | 0.586 274 19 | 0.751 225 66 | 0.325 492 62 | 1366 5854 | 0916 5701 | 397 3160 |
| | 30 | 0.599 856 18 | 0.741 953 45 | 0.321 473 35 | 1349 7453 | 0937 8349 | 406 5216 |
| | 31 | +0.613 267 76 | -0.732 469 74 | -0.317 362 52 | +1332 5041 | +958 8679 | +415 6291 |
| Aug. | 1 | 0.626 504 92 | 0.722 776 90 | 0.313 161 11 | 1314 8614 | 979 6593 | 424 6345 |
| | 2 | 0.639 563 65 | 0.712 877 39 | 0.308 870 18 | 1296 8181 | 1000 1994 | 433 5338 |
| | 3 | 0.652 439 95 | 0.702 773 78 | 0.304 490 80 | 1278 3754 | 1020 4784 | 442 3229 |
| | 4 | 0.665 129 83 | 0.692 468 73 | 0.300 024 10 | 1259 5352 | 1040 4861 | 450 9974 |
| | 5 | 0.677 629 34 | 0.681 965 00 | 0.295 471 25 | 1240 3001 | 1060 2122 | 459 5527 |
| | 6 | +0.689 934 53 | -0.671 265 46 | -0.290 833 46 | +1220 6732 | +1079 6457 | +467 9843 |
| | 7 | 0.702 041 51 | 0.660 373 09 | 0.286 112 00 | 1200 6589 | 1098 7751 | 476 2868 |
| | 8 | 0.713 946 43 | 0.649 291 01 | 0.281 308 17 | 1180 2628 | 1117 5885 | 484 4548 |
| | 9 | 0.725 645 52 | 0.638 022 42 | 0.276 423 37 | 1159 4924 | 1136 0739 | 492 4825 |
| | 10 | 0.737 135 07 | 0.626 570 66 | 0.271 459 01 | 1138 3573 | 1154 2196 | 500 3644 |
| | 11 | 0.748 411 49 | 0.614 939 19 | 0.266 416 59 | 1116 8693 | 1172 0148 | 508 0947 |
| | 12 | +0.759 471 32 | -0.603 131 57 | -0.261 297 64 | +1095 0422 | +1189 4503 | +515 6686 |
| | 13 | 0.770 311 25 | 0.591 151 41 | 0.256 103 75 | 1072 8913 | 1206 5191 | 523 0822 |
| | 14 | 0.780 928 12 | 0.579 002 42 | 0.250 836 54 | 1050 4326 | 1223 2168 | 530 3325 |
| | 15 | 0.791 318 93 | 0.566 688 32 | 0.245 497 65 | 1027 6822 | 1239 5413 | 537 4179 |
| | 16 | +0.801 480 84 | -0.554 212 84 | -0.240 088 73 | +1004 6554 | +1255 4934 | +544 3381 |

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of $10^{-9}$ a.u. per day

**FRAME BIAS, PRECESSION AND NUTATION, 2021**
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

| Date $0^h$ TT | | $M_{11}$ - 1 | $M_{12}$ | $M_{13}$ | $M_{21}$ | $M_{22}$ - 1 | $M_{23}$ | $M_{31}$ | $M_{32}$ | $M_{33}$ - 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| July | 1 | -1335 | -473 855 | -205 884 | +473 852 | -1123 | -1887 | +205 891 | +0912 | -212 |
| | 2 | 1335 | 473 886 | 205 898 | 473 883 | 1123 | 1894 | 205 904 | 0918 | 212 |
| | 3 | 1335 | 473 921 | 205 913 | 473 918 | 1123 | 1892 | 205 920 | 0916 | 212 |
| | 4 | 1335 | 473 968 | 205 933 | 473 965 | 1123 | 1883 | 205 940 | 0907 | 212 |
| | 5 | 1336 | 474 030 | 205 960 | 474 027 | 1124 | 1871 | 205 967 | 0895 | 212 |
| | 6 | 1336 | 474 108 | 205 994 | 474 105 | 1124 | 1859 | 206 001 | 0882 | 212 |
| | 7 | -1337 | -474 203 | -206 036 | +474 200 | -1124 | -1849 | +206 042 | +0872 | -212 |
| | 8 | 1337 | 474 311 | 206 083 | 474 309 | 1125 | 1846 | 206 089 | 0868 | 212 |
| | 9 | 1338 | 474 427 | 206 133 | 474 424 | 1125 | 1850 | 206 139 | 0872 | 212 |
| | 10 | 1339 | 474 544 | 206 183 | 474 541 | 1126 | 1863 | 206 190 | 0885 | 213 |
| | 11 | 1339 | 474 653 | 206 231 | 474 650 | 1126 | 1885 | 206 237 | 0906 | 213 |
| | 12 | 1340 | 474 748 | 206 272 | 474 745 | 1127 | 1914 | 206 279 | 0935 | 213 |
| | 13 | -1340 | -474 823 | -206 305 | +474 820 | -1127 | -1947 | +206 312 | +0967 | -213 |
| | 14 | 1340 | 474 878 | 206 329 | 474 875 | 1128 | 1978 | 206 336 | 0998 | 213 |
| | 15 | 1341 | 474 915 | 206 345 | 474 912 | 1128 | 2004 | 206 352 | 1024 | 213 |
| | 16 | 1341 | 474 941 | 206 356 | 474 938 | 1128 | 2020 | 206 363 | 1040 | 213 |
| | 17 | 1341 | 474 968 | 206 368 | 474 965 | 1128 | 2025 | 206 375 | 1045 | 213 |
| | 18 | 1341 | 475 007 | 206 385 | 475 004 | 1128 | 2019 | 206 392 | 1039 | 213 |
| | 19 | -1341 | -475 070 | -206 412 | +475 067 | -1128 | -2005 | +206 419 | +1025 | -213 |
| | 20 | 1342 | 475 161 | 206 452 | 475 158 | 1129 | 1990 | 206 459 | 1009 | 213 |
| | 21 | 1343 | 475 280 | 206 503 | 475 277 | 1129 | 1980 | 206 510 | 0999 | 213 |
| | 22 | 1343 | 475 416 | 206 562 | 475 413 | 1130 | 1982 | 206 569 | 1000 | 213 |
| | 23 | 1344 | 475 554 | 206 622 | 475 551 | 1131 | 1998 | 206 629 | 1015 | 213 |
| | 24 | 1345 | 475 678 | 206 676 | 475 675 | 1131 | 2026 | 206 683 | 1043 | 214 |
| | 25 | -1345 | -475 777 | -206 719 | +475 774 | -1132 | -2063 | +206 726 | +1079 | -214 |
| | 26 | 1346 | 475 847 | 206 749 | 475 843 | 1132 | 2101 | 206 757 | 1117 | 214 |
| | 27 | 1346 | 475 891 | 206 768 | 475 887 | 1132 | 2135 | 206 776 | 1151 | 214 |
| | 28 | 1346 | 475 917 | 206 780 | 475 914 | 1133 | 2160 | 206 788 | 1176 | 214 |
| | 29 | 1346 | 475 936 | 206 788 | 475 933 | 1133 | 2176 | 206 796 | 1191 | 214 |
| | 30 | 1347 | 475 957 | 206 797 | 475 954 | 1133 | 2182 | 206 805 | 1197 | 214 |
| | 31 | -1347 | -475 987 | -206 810 | +475 984 | -1133 | -2180 | +206 819 | +1195 | -214 |
| Aug. | 1 | 1347 | 476 032 | 206 830 | 476 028 | 1133 | 2173 | 206 838 | 1189 | 214 |
| | 2 | 1347 | 476 093 | 206 856 | 476 089 | 1133 | 2165 | 206 864 | 1180 | 214 |
| | 3 | 1348 | 476 170 | 206 890 | 476 167 | 1134 | 2159 | 206 898 | 1174 | 214 |
| | 4 | 1348 | 476 261 | 206 929 | 476 258 | 1134 | 2157 | 206 937 | 1172 | 214 |
| | 5 | 1349 | 476 362 | 206 973 | 476 359 | 1135 | 2163 | 206 981 | 1177 | 214 |
| | 6 | -1349 | -476 465 | -207 018 | +476 462 | -1135 | -2177 | +207 026 | +1191 | -214 |
| | 7 | 1350 | 476 564 | 207 061 | 476 560 | 1136 | 2201 | 207 069 | 1214 | 214 |
| | 8 | 1350 | 476 650 | 207 098 | 476 646 | 1136 | 2232 | 207 106 | 1245 | 214 |
| | 9 | 1351 | 476 717 | 207 127 | 476 713 | 1136 | 2268 | 207 136 | 1280 | 215 |
| | 10 | 1351 | 476 762 | 207 147 | 476 758 | 1137 | 2303 | 207 155 | 1316 | 215 |
| | 11 | 1351 | 476 787 | 207 158 | 476 783 | 1137 | 2334 | 207 167 | 1346 | 215 |
| | 12 | -1351 | -476 799 | -207 163 | +476 795 | -1137 | -2355 | +207 172 | +1367 | -215 |
| | 13 | 1351 | 476 809 | 207 167 | 476 805 | 1137 | 2365 | 207 176 | 1377 | 215 |
| | 14 | 1351 | 476 828 | 207 176 | 476 825 | 1137 | 2362 | 207 185 | 1375 | 215 |
| | 15 | 1352 | 476 869 | 207 193 | 476 865 | 1137 | 2352 | 207 202 | 1364 | 215 |
| | 16 | -1352 | -476 936 | -207 223 | +476 932 | -1137 | -2338 | +207 231 | +1350 | -215 |

Values are in units of $10^{-8}$

**POSITION AND VELOCITY OF THE EARTH, 2021**
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

| Date $0^h$ T.D.B. | | X | Y | Z | $\dot{X}$ | $\dot{Y}$ | $\dot{Z}$ |
|---|---|---|---|---|---|---|---|
| Aug. | 16 | +0.801 480 84 | -0.554 212 84 | -0.240 088 73 | +1004 6554 | +1255 4934 | +544 3381 |
| | 17 | 0.811 411 16 | 0.541 579 68 | 0.234 611 43 | 981 3656 | 1271 0761 | 551 0938 |
| | 18 | 0.821 107 32 | 0.528 792 53 | 0.229 067 40 | 957 8245 | 1286 2939 | 557 6872 |
| | 19 | 0.830 566 84 | 0.515 855 00 | 0.223 458 22 | 934 0402 | 1301 1528 | 564 1210 |
| | 20 | 0.839 787 33 | 0.502 770 65 | 0.217 785 50 | 910 0177 | 1315 6585 | 570 3982 |
| | 21 | 0.848 766 41 | 0.489 542 99 | 0.212 050 77 | 885 7592 | 1329 8161 | 576 5218 |
| | 22 | +0.857 501 72 | -0.476 175 48 | -0.206 255 57 | +861 2638 | +1343 6288 | +582 4942 |
| | 23 | 0.865 990 89 | 0.462 671 56 | 0.200 401 39 | 836 5291 | 1357 0971 | 588 3167 |
| | 24 | 0.874 231 50 | 0.449 034 69 | 0.194 489 73 | 811 5522 | 1370 2195 | 593 9894 |
| | 25 | 0.882 221 12 | 0.435 268 34 | 0.188 522 10 | 786 3302 | 1382 9915 | 599 5114 |
| | 26 | 0.889 957 28 | 0.421 376 05 | 0.182 500 01 | 760 8618 | 1395 4070 | 604 8807 |
| | 27 | 0.897 437 53 | 0.407 361 41 | 0.176 425 01 | 735 1467 | 1407 4587 | 610 0946 |
| | 28 | +0.904 659 40 | -0.393 228 11 | -0.170 298 65 | +709 1865 | +1419 1387 | +615 1500 |
| | 29 | 0.911 620 45 | 0.378 979 91 | 0.164 122 55 | 682 9841 | 1430 4389 | 620 0436 |
| | 30 | 0.918 318 29 | 0.364 620 63 | 0.157 898 33 | 656 5430 | 1441 3514 | 624 7720 |
| | 31 | 0.924 750 53 | 0.350 154 20 | 0.151 627 67 | 629 8677 | 1451 8680 | 629 3318 |
| Sept. | 1 | 0.930 914 88 | 0.335 584 61 | 0.145 312 27 | 602 9632 | 1461 9806 | 633 7194 |
| | 2 | 0.936 809 05 | 0.320 915 96 | 0.138 953 86 | 575 8350 | 1471 6809 | 637 9313 |
| | 3 | +0.942 430 85 | -0.306 152 40 | -0.132 554 24 | +548 4894 | +1480 9602 | +641 9634 |
| | 4 | 0.947 778 14 | 0.291 298 19 | 0.126 115 21 | 520 9336 | 1489 8090 | 645 8114 |
| | 5 | 0.952 848 85 | 0.276 357 68 | 0.119 638 64 | 493 1762 | 1498 2179 | 649 4708 |
| | 6 | 0.957 641 02 | 0.261 335 33 | 0.113 126 44 | 465 2277 | 1506 1768 | 652 9365 |
| | 7 | 0.962 152 81 | 0.246 235 68 | 0.106 580 57 | 437 1015 | 1513 6763 | 656 2038 |
| | 8 | 0.966 382 51 | 0.231 063 36 | 0.100 003 04 | 408 8130 | 1520 7083 | 659 2682 |
| | 9 | +0.970 328 59 | -0.215 823 09 | -0.093 395 90 | +380 3799 | +1527 2671 | +662 1261 |
| | 10 | 0.973 989 69 | 0.200 519 61 | 0.086 761 21 | 351 8216 | 1533 3497 | 664 7752 |
| | 11 | 0.977 364 67 | 0.185 157 68 | 0.080 101 09 | 323 1573 | 1538 9567 | 667 2149 |
| | 12 | 0.980 452 55 | 0.169 742 05 | 0.073 417 61 | 294 4048 | 1544 0916 | 669 4460 |
| | 13 | 0.983 252 53 | 0.154 277 40 | 0.066 712 86 | 265 5803 | 1548 7604 | 671 4708 |
| | 14 | 0.985 763 96 | 0.138 768 37 | 0.059 988 87 | 236 6967 | 1552 9707 | 673 2926 |
| | 15 | +0.987 986 30 | -0.123 219 49 | -0.053 247 67 | +207 7639 | +1556 7305 | +674 9152 |
| | 16 | 0.989 919 09 | 0.107 635 23 | 0.046 491 22 | 178 7889 | 1560 0483 | 676 3428 |
| | 17 | 0.991 561 95 | 0.092 019 98 | 0.039 721 45 | 149 7761 | 1562 9308 | 677 5790 |
| | 18 | 0.992 914 50 | 0.076 378 05 | 0.032 940 26 | 120 7277 | 1565 3837 | 678 6272 |
| | 19 | 0.993 976 39 | 0.060 713 72 | 0.026 149 52 | 91 6444 | 1567 4112 | 679 4903 |
| | 20 | 0.994 747 26 | 0.045 031 24 | 0.019 351 07 | 62 5255 | 1569 0148 | 680 1696 |
| | 21 | +0.995 226 78 | -0.029 334 84 | -0.012 546 74 | +33 3711 | +1570 1943 | +680 6661 |
| | 22 | 0.995 414 57 | -0.013 628 77 | -0.005 738 36 | +4 1809 | 1570 9478 | 680 9797 |
| | 23 | 0.995 310 28 | +0.002 082 69 | +0.001 072 24 | -25 0441 | 1571 2718 | 681 1093 |
| | 24 | 0.994 913 58 | 0.017 795 22 | 0.007 883 21 | 54 3015 | 1571 1619 | 681 0533 |
| | 25 | 0.994 224 15 | 0.033 504 46 | 0.014 692 68 | 83 5878 | 1570 6129 | 680 8100 |
| | 26 | 0.993 241 74 | 0.049 206 00 | 0.021 498 78 | 112 8984 | 1569 6197 | 680 3771 |
| | 27 | +0.991 966 13 | +0.064 895 36 | +0.028 299 59 | -142 2271 | +1568 1773 | +679 7524 |
| | 28 | 0.990 397 16 | 0.080 568 03 | 0.035 093 18 | 171 5677 | 1566 2804 | 678 9337 |
| | 29 | 0.988 534 76 | 0.096 219 44 | 0.041 877 61 | 200 9129 | 1563 9242 | 677 9188 |
| | 30 | 0.986 378 91 | 0.111 844 96 | 0.048 650 89 | 230 2551 | 1561 1033 | 676 7052 |
| Oct. | 1 | +0.983 929 69 | +0.127 439 94 | +0.055 411 04 | -259 5861 | +1557 8126 | +675 2904 |

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of $10^{-9}$ a.u. per day

## FRAME BIAS, PRECESSION AND NUTATION, 2021
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

| Date $0^h$ TT | | $M_{11}$ - 1 | $M_{12}$ | $M_{13}$ | $M_{21}$ | $M_{22}$ - 1 | $M_{23}$ | $M_{31}$ | $M_{32}$ | $M_{33}$ - 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Aug. | 16 | -1352 | -476 936 | -207 223 | +476 932 | -1137 | -2338 | +207 231 | +1350 | -215 |
| | 17 | 1353 | 477 029 | 207 263 | 477 026 | 1138 | 2328 | 207 272 | 1339 | 215 |
| | 18 | 1353 | 477 142 | 207 312 | 477 138 | 1138 | 2327 | 207 321 | 1338 | 215 |
| | 19 | 1354 | 477 260 | 207 363 | 477 257 | 1139 | 2339 | 207 372 | 1349 | 215 |
| | 20 | 1355 | 477 371 | 207 411 | 477 367 | 1139 | 2364 | 207 420 | 1373 | 215 |
| | 21 | 1355 | 477 461 | 207 450 | 477 457 | 1140 | 2397 | 207 459 | 1407 | 215 |
| | 22 | -1355 | -477 524 | -207 478 | +477 520 | -1140 | -2435 | +207 487 | +1444 | -215 |
| | 23 | 1356 | 477 560 | 207 493 | 477 556 | 1140 | 2471 | 207 503 | 1480 | 215 |
| | 24 | 1356 | 477 575 | 207 500 | 477 571 | 1140 | 2499 | 207 510 | 1508 | 215 |
| | 25 | 1356 | 477 579 | 207 502 | 477 575 | 1140 | 2517 | 207 511 | 1526 | 215 |
| | 26 | 1356 | 477 582 | 207 503 | 477 577 | 1140 | 2525 | 207 513 | 1534 | 215 |
| | 27 | 1356 | 477 591 | 207 507 | 477 587 | 1140 | 2524 | 207 517 | 1533 | 215 |
| | 28 | -1356 | -477 615 | -207 517 | +477 610 | -1141 | -2516 | +207 527 | +1525 | -215 |
| | 29 | 1356 | 477 654 | 207 535 | 477 650 | 1141 | 2506 | 207 544 | 1515 | 215 |
| | 30 | 1356 | 477 711 | 207 559 | 477 707 | 1141 | 2496 | 207 569 | 1505 | 215 |
| | 31 | 1357 | 477 783 | 207 591 | 477 779 | 1141 | 2490 | 207 600 | 1499 | 216 |
| Sept. | 1 | 1357 | 477 865 | 207 626 | 477 861 | 1142 | 2491 | 207 636 | 1498 | 216 |
| | 2 | 1358 | 477 953 | 207 664 | 477 949 | 1142 | 2499 | 207 674 | 1506 | 216 |
| | 3 | -1358 | -478 039 | -207 702 | +478 035 | -1143 | -2516 | +207 711 | +1523 | -216 |
| | 4 | 1359 | 478 115 | 207 735 | 478 111 | 1143 | 2542 | 207 745 | 1548 | 216 |
| | 5 | 1359 | 478 175 | 207 761 | 478 171 | 1143 | 2573 | 207 771 | 1579 | 216 |
| | 6 | 1359 | 478 214 | 207 778 | 478 209 | 1143 | 2605 | 207 788 | 1612 | 216 |
| | 7 | 1359 | 478 231 | 207 785 | 478 226 | 1144 | 2634 | 207 795 | 1641 | 216 |
| | 8 | 1359 | 478 232 | 207 786 | 478 227 | 1144 | 2655 | 207 796 | 1661 | 216 |
| | 9 | -1359 | -478 227 | -207 784 | +478 222 | -1144 | -2663 | +207 794 | +1669 | -216 |
| | 10 | 1359 | 478 229 | 207 785 | 478 225 | 1144 | 2658 | 207 795 | 1665 | 216 |
| | 11 | 1360 | 478 252 | 207 794 | 478 247 | 1144 | 2643 | 207 805 | 1649 | 216 |
| | 12 | 1360 | 478 301 | 207 816 | 478 297 | 1144 | 2624 | 207 826 | 1630 | 216 |
| | 13 | 1360 | 478 378 | 207 849 | 478 374 | 1144 | 2606 | 207 859 | 1612 | 216 |
| | 14 | 1361 | 478 475 | 207 892 | 478 471 | 1145 | 2597 | 207 902 | 1603 | 216 |
| | 15 | -1361 | -478 581 | -207 937 | +478 577 | -1145 | -2600 | +207 947 | +1605 | -216 |
| | 16 | 1362 | 478 681 | 207 981 | 478 677 | 1146 | 2615 | 207 991 | 1620 | 216 |
| | 17 | 1362 | 478 765 | 208 017 | 478 761 | 1146 | 2640 | 208 028 | 1644 | 216 |
| | 18 | 1363 | 478 824 | 208 043 | 478 820 | 1146 | 2670 | 208 053 | 1674 | 216 |
| | 19 | 1363 | 478 858 | 208 058 | 478 853 | 1147 | 2700 | 208 068 | 1703 | 216 |
| | 20 | 1363 | 478 869 | 208 063 | 478 865 | 1147 | 2723 | 208 073 | 1727 | 216 |
| | 21 | -1363 | -478 867 | -208 062 | +478 862 | -1147 | -2738 | +208 072 | +1741 | -216 |
| | 22 | 1363 | 478 860 | 208 059 | 478 856 | 1147 | 2742 | 208 070 | 1745 | 216 |
| | 23 | 1363 | 478 859 | 208 058 | 478 854 | 1147 | 2736 | 208 069 | 1739 | 216 |
| | 24 | 1363 | 478 870 | 208 063 | 478 866 | 1147 | 2722 | 208 074 | 1726 | 216 |
| | 25 | 1363 | 478 898 | 208 075 | 478 893 | 1147 | 2705 | 208 086 | 1708 | 217 |
| | 26 | 1363 | 478 943 | 208 095 | 478 939 | 1147 | 2687 | 208 106 | 1690 | 217 |
| | 27 | -1364 | -479 005 | -208 122 | +479 000 | -1147 | -2671 | +208 132 | +1674 | -217 |
| | 28 | 1364 | 479 079 | 208 154 | 479 075 | 1148 | 2661 | 208 165 | 1664 | 217 |
| | 29 | 1365 | 479 161 | 208 190 | 479 156 | 1148 | 2659 | 208 200 | 1661 | 217 |
| | 30 | 1365 | 479 243 | 208 225 | 479 239 | 1148 | 2665 | 208 236 | 1667 | 217 |
| Oct. | 1 | -1366 | -479 320 | -208 259 | +479 315 | -1149 | -2679 | +208 269 | +1680 | -217 |

Values are in units of $10^{-8}$

**POSITION AND VELOCITY OF THE EARTH, 2021**
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

| Date $0^h$ T.D.B. | | X | Y | Z | $\dot{X}$ | $\dot{Y}$ | $\dot{Z}$ |
|---|---|---|---|---|---|---|---|
| Oct. | 1 | +0.983 929 69 | +0.127 439 94 | +0.055 411 04 | -259 5861 | +1557 8126 | +675 2904 |
| | 2 | 0.981 187 26 | 0.142 999 63 | 0.062 156 02 | 288 8967 | 1554 0463 | 673 6716 |
| | 3 | 0.978 151 86 | 0.158 519 25 | 0.068 883 78 | 318 1763 | 1549 7980 | 671 8455 |
| | 4 | 0.974 823 88 | 0.173 993 96 | 0.075 592 23 | 347 4124 | 1545 0615 | 669 8088 |
| | 5 | 0.971 203 81 | 0.189 418 84 | 0.082 279 24 | 376 5901 | 1539 8311 | 667 5580 |
| | 6 | 0.967 292 33 | 0.204 788 92 | 0.088 942 66 | 405 6914 | 1534 1024 | 665 0902 |
| | 7 | +0.963 090 30 | +0.220 099 22 | +0.095 580 32 | -434 6963 | +1527 8738 | +662 4036 |
| | 8 | 0.958 598 80 | 0.235 344 74 | 0.102 190 01 | 463 5832 | 1521 1476 | 659 4979 |
| | 9 | 0.953 819 10 | 0.250 520 53 | 0.108 769 55 | 492 3315 | 1513 9299 | 656 3752 |
| | 10 | 0.948 752 69 | 0.265 621 73 | 0.115 316 80 | 520 9222 | 1506 2304 | 653 0390 |
| | 11 | 0.943 401 23 | 0.280 643 58 | 0.121 829 64 | 549 3404 | 1498 0614 | 649 4948 |
| | 12 | 0.937 766 50 | 0.295 581 44 | 0.128 306 02 | 577 5752 | 1489 4357 | 645 7483 |
| | 13 | +0.931 850 36 | +0.310 430 81 | +0.134 743 95 | -605 6193 | +1480 3658 | +641 8058 |
| | 14 | 0.925 654 76 | 0.325 187 31 | 0.141 141 50 | 633 4684 | 1470 8626 | 637 6726 |
| | 15 | 0.919 181 65 | 0.339 846 65 | 0.147 496 79 | 661 1200 | 1460 9353 | 633 3538 |
| | 16 | 0.912 433 02 | 0.354 404 62 | 0.153 807 97 | 688 5735 | 1450 5911 | 628 8536 |
| | 17 | 0.905 410 85 | 0.368 857 10 | 0.160 073 26 | 715 8281 | 1439 8354 | 624 1750 |
| | 18 | 0.898 117 12 | 0.383 199 97 | 0.166 290 89 | 742 8835 | 1428 6721 | 619 3205 |
| | 19 | +0.890 553 84 | +0.397 429 19 | +0.172 459 09 | -769 7392 | +1417 1034 | +614 2918 |
| | 20 | 0.882 723 01 | 0.411 540 69 | 0.178 576 14 | 796 3937 | 1405 1303 | 609 0900 |
| | 21 | 0.874 626 64 | 0.425 530 45 | 0.184 640 32 | 822 8455 | 1392 7526 | 603 7155 |
| | 22 | 0.866 266 79 | 0.439 394 40 | 0.190 649 88 | 849 0911 | 1379 9698 | 598 1681 |
| | 23 | 0.857 645 52 | 0.453 128 49 | 0.196 603 10 | 875 1265 | 1366 7807 | 592 4476 |
| | 24 | 0.848 764 97 | 0.466 728 65 | 0.202 498 25 | 900 9469 | 1353 1837 | 586 5535 |
| | 25 | +0.839 627 32 | +0.480 190 80 | +0.208 333 59 | -926 5458 | +1339 1776 | +580 4850 |
| | 26 | 0.830 234 82 | 0.493 510 83 | 0.214 107 37 | 951 9165 | 1324 7610 | 574 2415 |
| | 27 | 0.820 589 77 | 0.506 684 65 | 0.219 817 83 | 977 0518 | 1309 9327 | 567 8224 |
| | 28 | 0.810 694 59 | 0.519 708 11 | 0.225 463 23 | 1001 9435 | 1294 6916 | 561 2267 |
| | 29 | 0.800 551 75 | 0.532 577 10 | 0.231 041 78 | 1026 5830 | 1279 0364 | 554 4537 |
| | 30 | 0.790 163 80 | 0.545 287 45 | 0.236 551 71 | 1050 9607 | 1262 9656 | 547 5023 |
| | 31 | +0.779 533 44 | +0.557 835 02 | +0.241 991 22 | -1075 0662 | +1246 4775 | +540 3710 |
| Nov. | 1 | 0.768 663 43 | 0.570 215 61 | 0.247 358 52 | 1098 8872 | 1229 5705 | 533 0587 |
| | 2 | 0.757 556 69 | 0.582 425 03 | 0.252 651 79 | 1122 4087 | 1212 2434 | 525 5637 |
| | 3 | 0.746 216 31 | 0.594 459 08 | 0.257 869 19 | 1145 6135 | 1194 4967 | 517 8853 |
| | 4 | 0.734 645 54 | 0.606 313 57 | 0.263 008 88 | 1168 4820 | 1176 3332 | 510 0234 |
| | 5 | 0.722 847 86 | 0.617 984 38 | 0.268 069 05 | 1190 9931 | 1157 7606 | 501 9802 |
| | 6 | +0.710 826 94 | +0.629 467 46 | +0.273 047 90 | -1213 1269 | +1138 7905 | +493 7600 |
| | 7 | 0.698 586 64 | 0.640 758 91 | 0.277 943 68 | 1234 8665 | 1119 4385 | 485 3693 |
| | 8 | 0.686 130 97 | 0.651 855 02 | 0.282 754 74 | 1256 1992 | 1099 7228 | 476 8162 |
| | 9 | 0.673 464 03 | 0.662 752 22 | 0.287 479 49 | 1277 1183 | 1079 6614 | 468 1091 |
| | 10 | 0.660 589 99 | 0.673 447 15 | 0.292 116 44 | 1297 6210 | 1059 2713 | 459 2563 |
| | 11 | 0.647 513 00 | 0.683 936 59 | 0.296 664 16 | 1317 7075 | 1038 5664 | 450 2651 |
| | 12 | +0.634 237 22 | +0.694 217 47 | +0.301 121 30 | -1337 3796 | +1017 5583 | +441 1415 |
| | 13 | 0.620 766 78 | 0.704 286 78 | 0.305 486 56 | 1356 6394 | 996 2559 | 431 8904 |
| | 14 | 0.607 105 80 | 0.714 141 63 | 0.309 758 69 | 1375 4889 | 974 6666 | 422 5156 |
| | 15 | 0.593 258 37 | 0.723 779 17 | 0.313 936 47 | 1393 9294 | 952 7960 | 413 0205 |
| | 16 | +0.579 228 57 | +0.733 196 63 | +0.318 018 71 | -1411 9616 | +930 6489 | +403 4076 |

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of $10^{-9}$ a.u. per day

**FRAME BIAS, PRECESSION AND NUTATION, 2021**
MATRIX ELEMENTS FOR CONVERSION FROM
GCRS TO TRUE EQUINOX OF DATE

| Date $0^h$ TT | | $M_{11}$ - 1 | $M_{12}$ | $M_{13}$ | $M_{21}$ | $M_{22}$ - 1 | $M_{23}$ | $M_{31}$ | $M_{32}$ | $M_{33}$ - 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Oct. | 1 | -1366 | -479 320 | -208 259 | +479 315 | -1149 | -2679 | +208 269 | +1680 | -217 |
| | 2 | 1366 | 479 383 | 208 286 | 479 378 | 1149 | 2699 | 208 297 | 1701 | 217 |
| | 3 | 1366 | 479 428 | 208 306 | 479 423 | 1149 | 2724 | 208 316 | 1725 | 217 |
| | 4 | 1366 | 479 452 | 208 316 | 479 447 | 1149 | 2747 | 208 327 | 1748 | 217 |
| | 5 | 1366 | 479 457 | 208 318 | 479 452 | 1149 | 2763 | 208 329 | 1764 | 217 |
| | 6 | 1366 | 479 452 | 208 316 | 479 448 | 1149 | 2768 | 208 327 | 1769 | 217 |
| | 7 | -1366 | -479 451 | -208 316 | +479 446 | -1149 | -2759 | +208 327 | +1760 | -217 |
| | 8 | 1366 | 479 466 | 208 323 | 479 462 | 1149 | 2738 | 208 333 | 1739 | 217 |
| | 9 | 1367 | 479 510 | 208 342 | 479 506 | 1150 | 2709 | 208 352 | 1710 | 217 |
| | 10 | 1367 | 479 585 | 208 374 | 479 581 | 1150 | 2681 | 208 385 | 1682 | 217 |
| | 11 | 1368 | 479 685 | 208 417 | 479 680 | 1151 | 2660 | 208 428 | 1660 | 217 |
| | 12 | 1368 | 479 797 | 208 466 | 479 792 | 1151 | 2651 | 208 476 | 1651 | 217 |
| | 13 | -1369 | -479 905 | -208 513 | +479 901 | -1152 | -2656 | +208 523 | +1655 | -217 |
| | 14 | 1369 | 479 999 | 208 554 | 479 994 | 1152 | 2671 | 208 564 | 1670 | 218 |
| | 15 | 1370 | 480 069 | 208 584 | 480 064 | 1152 | 2692 | 208 595 | 1690 | 218 |
| | 16 | 1370 | 480 113 | 208 604 | 480 109 | 1153 | 2713 | 208 614 | 1712 | 218 |
| | 17 | 1370 | 480 136 | 208 613 | 480 131 | 1153 | 2731 | 208 624 | 1729 | 218 |
| | 18 | 1370 | 480 143 | 208 617 | 480 139 | 1153 | 2740 | 208 627 | 1738 | 218 |
| | 19 | -1370 | -480 145 | -208 617 | +480 140 | -1153 | -2738 | +208 628 | +1737 | -218 |
| | 20 | 1370 | 480 149 | 208 619 | 480 144 | 1153 | 2727 | 208 630 | 1726 | 218 |
| | 21 | 1370 | 480 164 | 208 626 | 480 160 | 1153 | 2708 | 208 637 | 1707 | 218 |
| | 22 | 1371 | 480 196 | 208 640 | 480 191 | 1153 | 2684 | 208 650 | 1682 | 218 |
| | 23 | 1371 | 480 246 | 208 661 | 480 241 | 1153 | 2658 | 208 672 | 1656 | 218 |
| | 24 | 1371 | 480 313 | 208 690 | 480 308 | 1154 | 2634 | 208 701 | 1632 | 218 |
| | 25 | -1372 | -480 394 | -208 726 | +480 390 | -1154 | -2615 | +208 736 | +1612 | -218 |
| | 26 | 1372 | 480 485 | 208 765 | 480 481 | 1154 | 2603 | 208 775 | 1600 | 218 |
| | 27 | 1373 | 480 579 | 208 806 | 480 575 | 1155 | 2600 | 208 816 | 1596 | 218 |
| | 28 | 1373 | 480 669 | 208 845 | 480 665 | 1155 | 2604 | 208 855 | 1600 | 218 |
| | 29 | 1374 | 480 749 | 208 880 | 480 744 | 1156 | 2616 | 208 890 | 1612 | 218 |
| | 30 | 1374 | 480 813 | 208 908 | 480 809 | 1156 | 2633 | 208 918 | 1628 | 218 |
| | 31 | -1374 | -480 858 | -208 927 | +480 854 | -1156 | -2650 | +208 938 | +1645 | -218 |
| Nov. | 1 | 1375 | 480 885 | 208 939 | 480 880 | 1156 | 2663 | 208 949 | 1658 | 218 |
| | 2 | 1375 | 480 898 | 208 945 | 480 893 | 1156 | 2668 | 208 955 | 1663 | 218 |
| | 3 | 1375 | 480 908 | 208 949 | 480 904 | 1156 | 2660 | 208 960 | 1655 | 218 |
| | 4 | 1375 | 480 930 | 208 959 | 480 926 | 1156 | 2638 | 208 969 | 1633 | 218 |
| | 5 | 1375 | 480 978 | 208 979 | 480 974 | 1157 | 2607 | 208 990 | 1601 | 218 |
| | 6 | -1376 | -481 059 | -209 015 | +481 055 | -1157 | -2572 | +209 025 | +1566 | -218 |
| | 7 | 1376 | 481 172 | 209 064 | 481 168 | 1158 | 2542 | 209 074 | 1536 | 219 |
| | 8 | 1377 | 481 304 | 209 121 | 481 300 | 1158 | 2524 | 209 131 | 1518 | 219 |
| | 9 | 1378 | 481 439 | 209 179 | 481 435 | 1159 | 2521 | 209 189 | 1514 | 219 |
| | 10 | 1378 | 481 560 | 209 232 | 481 555 | 1160 | 2531 | 209 242 | 1523 | 219 |
| | 11 | 1379 | 481 656 | 209 274 | 481 652 | 1160 | 2549 | 209 284 | 1541 | 219 |
| | 12 | -1379 | -481 726 | -209 304 | +481 722 | -1160 | -2569 | +209 314 | +1560 | -219 |
| | 13 | 1380 | 481 772 | 209 324 | 481 768 | 1161 | 2585 | 209 334 | 1576 | 219 |
| | 14 | 1380 | 481 801 | 209 337 | 481 797 | 1161 | 2594 | 209 347 | 1585 | 219 |
| | 15 | 1380 | 481 822 | 209 346 | 481 817 | 1161 | 2593 | 209 356 | 1584 | 219 |
| | 16 | -1380 | -481 843 | -209 355 | +481 839 | -1161 | -2583 | +209 365 | +1574 | -219 |

Values are in units of $10^{-8}$

**POSITION AND VELOCITY OF THE EARTH, 2021**
ORIGIN AT SOLAR SYSTEM BARYCENTRE
MEAN EQUATOR AND EQUINOX J 2000.0

| Date $0^h$ T.D.B. | | X | Y | Z | $\dot{X}$ | $\dot{Y}$ | $\dot{Z}$ |
|---|---|---|---|---|---|---|---|
| Nov. | 16 | +0.579 228 57 | +0.733 196 63 | +0.318 018 71 | -1411 9616 | +930 6489 | +403 4076 |
| | 17 | 0.565 020 50 | 0.742 391 24 | 0.322 004 24 | 1429 5854 | 908 2294 | 393 6791 |
| | 18 | 0.550 638 23 | 0.751 360 32 | 0.325 891 91 | 1446 8001 | 885 5406 | 383 8367 |
| | 19 | 0.536 085 86 | 0.760 101 17 | 0.329 680 60 | 1463 6043 | 862 5856 | 373 8819 |
| | 20 | 0.521 367 52 | 0.768 611 15 | 0.333 369 18 | 1479 9956 | 839 3666 | 363 8159 |
| | 21 | 0.506 487 34 | 0.776 887 63 | 0.336 956 55 | 1495 9709 | 815 8860 | 353 6395 |
| | 22 | +0.491 449 50 | +0.784 928 00 | +0.340 441 61 | -1511 5263 | +792 1461 | +343 3536 |
| | 23 | 0.476 258 23 | 0.792 729 69 | 0.343 823 26 | 1526 6572 | 768 1488 | 332 9590 |
| | 24 | 0.460 917 79 | 0.800 290 13 | 0.347 100 43 | 1541 3584 | 743 8964 | 322 4563 |
| | 25 | 0.445 432 51 | 0.807 606 78 | 0.350 272 03 | 1555 6235 | 719 3913 | 311 8463 |
| | 26 | 0.429 806 79 | 0.814 677 12 | 0.353 337 00 | 1569 4462 | 694 6359 | 301 1295 |
| | 27 | 0.414 045 09 | 0.821 498 67 | 0.356 294 27 | 1582 8188 | 669 6327 | 290 3065 |
| | 28 | +0.398 151 95 | +0.828 068 96 | +0.359 142 77 | -1595 7328 | +644 3842 | +279 3777 |
| | 29 | 0.382 132 00 | 0.834 385 54 | 0.361 881 47 | 1608 1783 | 618 8930 | 268 3436 |
| | 30 | 0.365 989 98 | 0.840 446 02 | 0.364 509 30 | 1620 1433 | 593 1627 | 257 2047 |
| Dec. | 1 | 0.349 730 78 | 0.846 248 02 | 0.367 025 22 | 1631 6140 | 567 1981 | 245 9622 |
| | 2 | 0.333 359 40 | 0.851 789 23 | 0.369 428 20 | 1642 5745 | 541 0070 | 234 6181 |
| | 3 | 0.316 881 04 | 0.857 067 44 | 0.371 717 25 | 1653 0077 | 514 6005 | 223 1766 |
| | 4 | +0.300 301 06 | +0.862 080 57 | +0.373 891 43 | -1662 8980 | +487 9944 | +211 6437 |
| | 5 | 0.283 624 94 | 0.866 826 73 | 0.375 949 85 | 1672 2326 | 461 2085 | 200 0275 |
| | 6 | 0.266 858 28 | 0.871 304 22 | 0.377 891 74 | 1681 0044 | 434 2646 | 188 3383 |
| | 7 | 0.250 006 73 | 0.875 511 57 | 0.379 716 41 | 1689 2116 | 407 1849 | 176 5863 |
| | 8 | 0.233 075 92 | 0.879 447 53 | 0.381 423 29 | 1696 8577 | 379 9890 | 164 7813 |
| | 9 | 0.216 071 43 | 0.883 111 01 | 0.383 011 88 | 1703 9495 | 352 6930 | 152 9315 |
| | 10 | +0.198 998 75 | +0.886 501 10 | +0.384 481 79 | -1710 4944 | +325 3098 | +141 0437 |
| | 11 | 0.181 863 33 | 0.889 616 95 | 0.385 832 65 | 1716 5001 | 297 8493 | 129 1232 |
| | 12 | 0.164 670 53 | 0.892 457 85 | 0.387 064 16 | 1721 9730 | 270 3195 | 117 1741 |
| | 13 | 0.147 425 63 | 0.895 023 13 | 0.388 176 05 | 1726 9187 | 242 7269 | 105 1999 |
| | 14 | 0.130 133 90 | 0.897 312 20 | 0.389 168 08 | 1731 3413 | 215 0774 | 93 2036 |
| | 15 | 0.112 800 54 | 0.899 324 51 | 0.390 040 05 | 1735 2444 | 187 3764 | 81 1877 |
| | 16 | +0.095 430 73 | +0.901 059 57 | +0.390 791 78 | -1738 6308 | +159 6290 | +69 1547 |
| | 17 | 0.078 029 64 | 0.902 516 95 | 0.391 423 10 | 1741 5026 | 131 8401 | 57 1067 |
| | 18 | 0.060 602 39 | 0.903 696 25 | 0.391 933 87 | 1743 8617 | 104 0139 | 45 0457 |
| | 19 | 0.043 154 11 | 0.904 597 12 | 0.392 323 97 | 1745 7088 | 76 1548 | 32 9734 |
| | 20 | 0.025 689 92 | 0.905 219 25 | 0.392 593 31 | 1747 0446 | 48 2668 | 20 8914 |
| | 21 | +0.008 214 92 | 0.905 562 37 | 0.392 741 77 | 1747 8685 | +20 3536 | +8 8009 |
| | 22 | -0.009 265 74 | +0.905 626 25 | +0.392 769 30 | -1748 1793 | -7 5809 | -3 2964 |
| | 23 | 0.026 746 95 | 0.905 410 69 | 0.392 675 83 | 1747 9752 | 35 5329 | 15 3996 |
| | 24 | 0.044 223 52 | 0.904 915 55 | 0.392 461 30 | 1747 2530 | 63 4982 | 27 5074 |
| | 25 | 0.061 690 27 | 0.904 140 70 | 0.392 125 67 | 1746 0091 | 91 4725 | 39 6184 |
| | 26 | 0.079 141 95 | 0.903 086 08 | 0.391 668 92 | 1744 2385 | 119 4510 | 51 7313 |
| | 27 | 0.096 573 26 | 0.901 751 68 | 0.391 091 04 | 1741 9353 | 147 4284 | 63 8446 |
| | 28 | -0.113 978 85 | +0.900 137 54 | +0.390 392 03 | -1739 0923 | -175 3983 | -75 9565 |
| | 29 | 0.131 353 28 | 0.898 243 77 | 0.389 571 93 | 1735 7004 | 203 3527 | 88 0641 |
| | 30 | 0.148 691 00 | 0.896 070 57 | 0.388 630 78 | 1731 7501 | 231 2814 | 100 1642 |
| | 31 | 0.165 986 39 | 0.893 618 27 | 0.387 568 68 | 1727 2311 | 259 1709 | 112 2516 |
| | 32 | -0.183 233 70 | +0.890 887 34 | +0.386 385 81 | -1722 1344 | -287 0041 | -124 3193 |

$\dot{X}$, $\dot{Y}$, $\dot{Z}$ are in units of $10^{-9}$ a.u. per day

# FRAME BIAS, PRECESSION AND NUTATION, 2021
## MATRIX ELEMENTS FOR CONVERSION FROM GCRS TO TRUE EQUINOX OF DATE

| Date $0^h$ TT | | $M_{11}$ - 1 | $M_{12}$ | $M_{13}$ | $M_{21}$ | $M_{22}$ - 1 | $M_{23}$ | $M_{31}$ | $M_{32}$ | $M_{33}$ - 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov. | 16 | -1380 | -481 843 | -209 355 | +481 839 | -1161 | -2583 | +209 365 | +1574 | -219 |
| | 17 | 1380 | 481 874 | 209 369 | 481 870 | 1161 | 2564 | 209 379 | 1555 | 219 |
| | 18 | 1380 | 481 920 | 209 389 | 481 916 | 1161 | 2540 | 209 398 | 1531 | 219 |
| | 19 | 1381 | 481 984 | 209 416 | 481 980 | 1162 | 2513 | 209 426 | 1504 | 219 |
| | 20 | 1381 | 482 066 | 209 452 | 482 062 | 1162 | 2488 | 209 461 | 1478 | 219 |
| | 21 | 1382 | 482 163 | 209 494 | 482 159 | 1162 | 2467 | 209 504 | 1457 | 219 |
| | 22 | -1382 | -482 271 | -209 541 | +482 267 | -1163 | -2453 | +209 550 | +1443 | -220 |
| | 23 | 1383 | 482 383 | 209 590 | 482 379 | 1163 | 2448 | 209 599 | 1437 | 220 |
| | 24 | 1384 | 482 494 | 209 638 | 482 489 | 1164 | 2451 | 209 647 | 1439 | 220 |
| | 25 | 1384 | 482 595 | 209 682 | 482 591 | 1165 | 2461 | 209 691 | 1449 | 220 |
| | 26 | 1385 | 482 682 | 209 719 | 482 678 | 1165 | 2477 | 209 729 | 1465 | 220 |
| | 27 | 1385 | 482 751 | 209 749 | 482 747 | 1165 | 2496 | 209 759 | 1483 | 220 |
| | 28 | -1386 | -482 802 | -209 772 | +482 798 | -1166 | -2512 | +209 781 | +1499 | -220 |
| | 29 | 1386 | 482 838 | 209 787 | 482 834 | 1166 | 2522 | 209 797 | 1509 | 220 |
| | 30 | 1386 | 482 867 | 209 800 | 482 863 | 1166 | 2522 | 209 810 | 1509 | 220 |
| Dec. | 1 | 1386 | 482 901 | 209 815 | 482 897 | 1166 | 2509 | 209 824 | 1496 | 220 |
| | 2 | 1386 | 482 954 | 209 838 | 482 949 | 1166 | 2485 | 209 847 | 1472 | 220 |
| | 3 | 1387 | 483 037 | 209 874 | 483 032 | 1167 | 2454 | 209 883 | 1441 | 220 |
| | 4 | -1388 | -483 154 | -209 925 | +483 150 | -1167 | -2425 | +209 934 | +1410 | -220 |
| | 5 | 1388 | 483 300 | 209 988 | 483 296 | 1168 | 2405 | 209 997 | 1390 | 221 |
| | 6 | 1389 | 483 458 | 210 056 | 483 454 | 1169 | 2400 | 210 066 | 1384 | 221 |
| | 7 | 1390 | 483 609 | 210 122 | 483 605 | 1169 | 2410 | 210 131 | 1394 | 221 |
| | 8 | 1391 | 483 736 | 210 177 | 483 732 | 1170 | 2432 | 210 186 | 1415 | 221 |
| | 9 | 1391 | 483 834 | 210 220 | 483 830 | 1170 | 2459 | 210 229 | 1441 | 221 |
| | 10 | -1392 | -483 904 | -210 250 | +483 899 | -1171 | -2483 | +210 259 | +1466 | -221 |
| | 11 | 1392 | 483 952 | 210 271 | 483 948 | 1171 | 2501 | 210 280 | 1483 | 221 |
| | 12 | 1392 | 483 989 | 210 287 | 483 984 | 1171 | 2509 | 210 296 | 1491 | 221 |
| | 13 | 1393 | 484 024 | 210 302 | 484 020 | 1171 | 2507 | 210 312 | 1489 | 221 |
| | 14 | 1393 | 484 066 | 210 320 | 484 062 | 1172 | 2497 | 210 330 | 1479 | 221 |
| | 15 | 1393 | 484 121 | 210 344 | 484 117 | 1172 | 2481 | 210 354 | 1462 | 221 |
| | 16 | -1394 | -484 193 | -210 376 | +484 189 | -1172 | -2461 | +210 385 | +1443 | -221 |
| | 17 | 1394 | 484 283 | 210 415 | 484 279 | 1173 | 2443 | 210 424 | 1424 | 221 |
| | 18 | 1395 | 484 389 | 210 461 | 484 385 | 1173 | 2428 | 210 470 | 1408 | 221 |
| | 19 | 1395 | 484 506 | 210 511 | 484 502 | 1174 | 2419 | 210 521 | 1399 | 222 |
| | 20 | 1396 | 484 629 | 210 565 | 484 625 | 1174 | 2419 | 210 574 | 1399 | 222 |
| | 21 | 1397 | 484 750 | 210 617 | 484 746 | 1175 | 2428 | 210 627 | 1407 | 222 |
| | 22 | -1397 | -484 863 | -210 666 | +484 859 | -1175 | -2445 | +210 676 | +1424 | -222 |
| | 23 | 1398 | 484 962 | 210 709 | 484 958 | 1176 | 2468 | 210 719 | 1446 | 222 |
| | 24 | 1398 | 485 044 | 210 745 | 485 039 | 1176 | 2494 | 210 754 | 1472 | 222 |
| | 25 | 1399 | 485 106 | 210 772 | 485 102 | 1177 | 2519 | 210 782 | 1497 | 222 |
| | 26 | 1399 | 485 153 | 210 792 | 485 149 | 1177 | 2539 | 210 802 | 1517 | 222 |
| | 27 | 1399 | 485 190 | 210 808 | 485 185 | 1177 | 2551 | 210 818 | 1528 | 222 |
| | 28 | -1399 | -485 226 | -210 824 | +485 222 | -1177 | -2552 | +210 834 | +1529 | -222 |
| | 29 | 1400 | 485 275 | 210 845 | 485 271 | 1177 | 2541 | 210 855 | 1518 | 222 |
| | 30 | 1400 | 485 347 | 210 877 | 485 343 | 1178 | 2522 | 210 886 | 1499 | 222 |
| | 31 | 1401 | 485 451 | 210 922 | 485 447 | 1178 | 2501 | 210 931 | 1477 | 222 |
| | 32 | -1402 | -485 585 | -210 980 | +485 581 | -1179 | -2485 | +210 990 | +1461 | -223 |

Values are in units of $10^{-8}$

**APPARENT PLACES OF POLARIS, 2021**

FOR $0^h$ TERRESTRIAL TIME

| α Ursae Minoris | | | Mag. 2.02 | | | | Sp. F8v | |
|---|---|---|---|---|---|---|---|---|
| | JANUARY | | FEBRUARY | | MARCH | | APRIL | |
| Date | Right Ascension | Declination | Right Ascension | Declination | Right Ascension | Declination | Right Ascension | Declination |
| | h m s | ° ' " | h m s | ° ' " | h m s | ° ' " | h m s | ° ' " |
| 1 | 2 59 10 | +89 21 21 | 2 58 15 | +89 21 26 | 2 57 22 | +89 21 25 | 2 56 38 | +89 21 18 |
| 2 | 2 59 08 | +89 21 21 | 2 58 13 | +89 21 26 | 2 57 20 | +89 21 24 | 2 56 38 | +89 21 18 |
| 3 | 2 59 06 | +89 21 21 | 2 58 11 | +89 21 26 | 2 57 18 | +89 21 24 | 2 56 37 | +89 21 18 |
| 4 | 2 59 05 | +89 21 21 | 2 58 09 | +89 21 26 | 2 57 17 | +89 21 24 | 2 56 36 | +89 21 17 |
| 5 | 2 59 03 | +89 21 22 | 2 58 08 | +89 21 26 | 2 57 15 | +89 21 24 | 2 56 36 | +89 21 17 |
| 6 | 2 59 01 | +89 21 22 | 2 58 06 | +89 21 26 | 2 57 14 | +89 21 24 | 2 56 35 | +89 21 17 |
| 7 | 2 58 60 | +89 21 22 | 2 58 04 | +89 21 26 | 2 57 13 | +89 21 24 | 2 56 34 | +89 21 17 |
| 8 | 2 58 58 | +89 21 22 | 2 58 03 | +89 21 26 | 2 57 11 | +89 21 23 | 2 56 33 | +89 21 17 |
| 9 | 2 58 57 | +89 21 22 | 2 58 01 | +89 21 26 | 2 57 10 | +89 21 23 | 2 56 32 | +89 21 16 |
| 10 | 2 58 55 | +89 21 22 | 2 57 59 | +89 21 26 | 2 57 08 | +89 21 23 | 2 56 31 | +89 21 16 |
| 11 | 2 58 54 | +89 21 23 | 2 57 57 | +89 21 26 | 2 57 06 | +89 21 23 | 2 56 30 | +89 21 16 |
| 12 | 2 58 53 | +89 21 23 | 2 57 55 | +89 21 26 | 2 57 04 | +89 21 23 | 2 56 29 | +89 21 15 |
| 13 | 2 58 51 | +89 21 23 | 2 57 53 | +89 21 26 | 2 57 02 | +89 21 23 | 2 56 29 | +89 21 15 |
| 14 | 2 58 49 | +89 21 23 | 2 57 50 | +89 21 26 | 2 57 01 | +89 21 23 | 2 56 28 | +89 21 15 |
| 15 | 2 58 48 | +89 21 24 | 2 57 48 | +89 21 26 | 2 56 59 | +89 21 22 | 2 56 28 | +89 21 14 |
| 16 | 2 58 46 | +89 21 24 | 2 57 46 | +89 21 26 | 2 56 57 | +89 21 22 | 2 56 27 | +89 21 14 |
| 17 | 2 58 44 | +89 21 24 | 2 57 44 | +89 21 26 | 2 56 56 | +89 21 22 | 2 56 27 | +89 21 14 |
| 18 | 2 58 42 | +89 21 24 | 2 57 42 | +89 21 25 | 2 56 55 | +89 21 22 | 2 56 27 | +89 21 13 |
| 19 | 2 58 40 | +89 21 24 | 2 57 40 | +89 21 25 | 2 56 54 | +89 21 21 | 2 56 27 | +89 21 13 |
| 20 | 2 58 38 | +89 21 24 | 2 57 39 | +89 21 25 | 2 56 52 | +89 21 21 | 2 56 27 | +89 21 13 |
| 21 | 2 58 36 | +89 21 24 | 2 57 37 | +89 21 25 | 2 56 51 | +89 21 21 | 2 56 26 | +89 21 13 |
| 22 | 2 58 34 | +89 21 24 | 2 57 35 | +89 21 25 | 2 56 50 | +89 21 21 | 2 56 26 | +89 21 12 |
| 23 | 2 58 32 | +89 21 25 | 2 57 34 | +89 21 25 | 2 56 49 | +89 21 20 | 2 56 25 | +89 21 12 |
| 24 | 2 58 31 | +89 21 25 | 2 57 32 | +89 21 25 | 2 56 48 | +89 21 20 | 2 56 25 | +89 21 12 |
| 25 | 2 58 29 | +89 21 25 | 2 57 30 | +89 21 25 | 2 56 46 | +89 21 20 | 2 56 24 | +89 21 11 |
| 26 | 2 58 27 | +89 21 25 | 2 57 28 | +89 21 25 | 2 56 45 | +89 21 20 | 2 56 24 | +89 21 11 |
| 27 | 2 58 26 | +89 21 25 | 2 57 26 | +89 21 25 | 2 56 44 | +89 21 20 | 2 56 24 | +89 21 11 |
| 28 | 2 58 24 | +89 21 25 | 2 57 24 | +89 21 25 | 2 56 42 | +89 21 19 | 2 56 24 | +89 21 10 |
| 29 | 2 58 22 | +89 21 25 | | | 2 56 41 | +89 21 19 | 2 56 25 | +89 21 10 |
| 30 | 2 58 20 | +89 21 25 | | | 2 56 40 | +89 21 19 | 2 56 25 | +89 21 10 |
| 31 | 2 58 18 | +89 21 25 | | | 2 56 39 | +89 21 19 | | |

**APPARENT PLACES OF POLARIS, 2021**

FOR $0^h$ TERRESTRIAL TIME

| α Ursae Minoris | | | | | | | | | | | | | Mag. 2.02 | | | | | | | | Sp. F8v | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MAY | | | | | | JUNE | | | | | | JULY | | | | | | AUGUST | | | | | |
| Date | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | | Right Ascension | | | Declination | | |
| | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " | h | m | s | ° | ' | " |
| 1 | 2 | 56 | 25 | +89 | 21 | 10 | 2 | 56 | 44 | +89 | 21 | 01 | 2 | 57 | 28 | +89 | 20 | 56 | 2 | 58 | 28 | +89 | 20 | 54 |
| 2 | 2 | 56 | 26 | +89 | 21 | 09 | 2 | 56 | 45 | +89 | 21 | 01 | 2 | 57 | 29 | +89 | 20 | 56 | 2 | 58 | 30 | +89 | 20 | 54 |
| 3 | 2 | 56 | 26 | +89 | 21 | 09 | 2 | 56 | 46 | +89 | 21 | 01 | 2 | 57 | 31 | +89 | 20 | 55 | 2 | 58 | 32 | +89 | 20 | 54 |
| 4 | 2 | 56 | 26 | +89 | 21 | 09 | 2 | 56 | 47 | +89 | 21 | 00 | 2 | 57 | 33 | +89 | 20 | 55 | 2 | 58 | 34 | +89 | 20 | 55 |
| 5 | 2 | 56 | 26 | +89 | 21 | 08 | 2 | 56 | 48 | +89 | 21 | 00 | 2 | 57 | 35 | +89 | 20 | 55 | 2 | 58 | 37 | +89 | 20 | 55 |
| 6 | 2 | 56 | 26 | +89 | 21 | 08 | 2 | 56 | 49 | +89 | 20 | 60 | 2 | 57 | 37 | +89 | 20 | 55 | 2 | 58 | 39 | +89 | 20 | 55 |
| 7 | 2 | 56 | 26 | +89 | 21 | 08 | 2 | 56 | 50 | +89 | 20 | 60 | 2 | 57 | 39 | +89 | 20 | 55 | 2 | 58 | 41 | +89 | 20 | 55 |
| 8 | 2 | 56 | 26 | +89 | 21 | 08 | 2 | 56 | 52 | +89 | 20 | 59 | 2 | 57 | 41 | +89 | 20 | 55 | 2 | 58 | 43 | +89 | 20 | 55 |
| 9 | 2 | 56 | 26 | +89 | 21 | 07 | 2 | 56 | 53 | +89 | 20 | 59 | 2 | 57 | 43 | +89 | 20 | 55 | 2 | 58 | 45 | +89 | 20 | 55 |
| 10 | 2 | 56 | 26 | +89 | 21 | 07 | 2 | 56 | 55 | +89 | 20 | 59 | 2 | 57 | 45 | +89 | 20 | 55 | 2 | 58 | 47 | +89 | 20 | 55 |
| 11 | 2 | 56 | 27 | +89 | 21 | 07 | 2 | 56 | 56 | +89 | 20 | 59 | 2 | 57 | 47 | +89 | 20 | 55 | 2 | 58 | 48 | +89 | 20 | 55 |
| 12 | 2 | 56 | 27 | +89 | 21 | 06 | 2 | 56 | 58 | +89 | 20 | 58 | 2 | 57 | 49 | +89 | 20 | 55 | 2 | 58 | 50 | +89 | 20 | 55 |
| 13 | 2 | 56 | 28 | +89 | 21 | 06 | 2 | 56 | 59 | +89 | 20 | 58 | 2 | 57 | 50 | +89 | 20 | 55 | 2 | 58 | 52 | +89 | 20 | 55 |
| 14 | 2 | 56 | 29 | +89 | 21 | 06 | 2 | 57 | 01 | +89 | 20 | 58 | 2 | 57 | 52 | +89 | 20 | 55 | 2 | 58 | 54 | +89 | 20 | 55 |
| 15 | 2 | 56 | 30 | +89 | 21 | 05 | 2 | 57 | 02 | +89 | 20 | 58 | 2 | 57 | 54 | +89 | 20 | 55 | 2 | 58 | 56 | +89 | 20 | 56 |
| 16 | 2 | 56 | 30 | +89 | 21 | 05 | 2 | 57 | 03 | +89 | 20 | 58 | 2 | 57 | 55 | +89 | 20 | 54 | 2 | 58 | 59 | +89 | 20 | 56 |
| 17 | 2 | 56 | 31 | +89 | 21 | 05 | 2 | 57 | 05 | +89 | 20 | 58 | 2 | 57 | 57 | +89 | 20 | 54 | 2 | 59 | 01 | +89 | 20 | 56 |
| 18 | 2 | 56 | 32 | +89 | 21 | 05 | 2 | 57 | 06 | +89 | 20 | 57 | 2 | 57 | 59 | +89 | 20 | 54 | 2 | 59 | 03 | +89 | 20 | 56 |
| 19 | 2 | 56 | 32 | +89 | 21 | 04 | 2 | 57 | 07 | +89 | 20 | 57 | 2 | 58 | 01 | +89 | 20 | 54 | 2 | 59 | 06 | +89 | 20 | 56 |
| 20 | 2 | 56 | 33 | +89 | 21 | 04 | 2 | 57 | 09 | +89 | 20 | 57 | 2 | 58 | 04 | +89 | 20 | 54 | 2 | 59 | 08 | +89 | 20 | 56 |
| 21 | 2 | 56 | 33 | +89 | 21 | 04 | 2 | 57 | 10 | +89 | 20 | 57 | 2 | 58 | 06 | +89 | 20 | 54 | 2 | 59 | 10 | +89 | 20 | 56 |
| 22 | 2 | 56 | 34 | +89 | 21 | 04 | 2 | 57 | 12 | +89 | 20 | 57 | 2 | 58 | 08 | +89 | 20 | 54 | 2 | 59 | 12 | +89 | 20 | 57 |
| 23 | 2 | 56 | 34 | +89 | 21 | 03 | 2 | 57 | 14 | +89 | 20 | 57 | 2 | 58 | 11 | +89 | 20 | 54 | 2 | 59 | 13 | +89 | 20 | 57 |
| 24 | 2 | 56 | 35 | +89 | 21 | 03 | 2 | 57 | 16 | +89 | 20 | 56 | 2 | 58 | 13 | +89 | 20 | 54 | 2 | 59 | 15 | +89 | 20 | 57 |
| 25 | 2 | 56 | 36 | +89 | 21 | 03 | 2 | 57 | 18 | +89 | 20 | 56 | 2 | 58 | 15 | +89 | 20 | 54 | 2 | 59 | 17 | +89 | 20 | 57 |
| 26 | 2 | 56 | 37 | +89 | 21 | 02 | 2 | 57 | 20 | +89 | 20 | 56 | 2 | 58 | 16 | +89 | 20 | 54 | 2 | 59 | 19 | +89 | 20 | 57 |
| 27 | 2 | 56 | 39 | +89 | 21 | 02 | 2 | 57 | 22 | +89 | 20 | 56 | 2 | 58 | 18 | +89 | 20 | 54 | 2 | 59 | 20 | +89 | 20 | 57 |
| 28 | 2 | 56 | 40 | +89 | 21 | 02 | 2 | 57 | 23 | +89 | 20 | 56 | 2 | 58 | 20 | +89 | 20 | 54 | 2 | 59 | 22 | +89 | 20 | 57 |
| 29 | 2 | 56 | 41 | +89 | 21 | 02 | 2 | 57 | 25 | +89 | 20 | 56 | 2 | 58 | 22 | +89 | 20 | 54 | 2 | 59 | 25 | +89 | 20 | 58 |
| 30 | 2 | 56 | 42 | +89 | 21 | 01 | 2 | 57 | 26 | +89 | 20 | 56 | 2 | 58 | 24 | +89 | 20 | 54 | 2 | 59 | 27 | +89 | 20 | 58 |
| 31 | 2 | 56 | 43 | +89 | 21 | 01 | | | | | | | 2 | 58 | 26 | +89 | 20 | 54 | 2 | 59 | 29 | +89 | 20 | 58 |

**APPARENT PLACES OF POLARIS, 2021**

FOR $0^h$ TERRESTRIAL TIME

| α Ursae Minoris | | | Mag. 2.02 | | | | Sp. F8v | |
|---|---|---|---|---|---|---|---|---|
| | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
| Date | Right Ascension | Declination | Right Ascension | Declination | Right Ascension | Declination | Right Ascension | Declination |
| | h m s | ° ' " | h m s | ° ' " | h m s | ° ' " | h m s | ° ' " |
| 1 | 2 59 31 | +89 20 58 | 3 00 22 | +89 21 06 | 3 00 54 | +89 21 17 | 3 00 57 | +89 21 28 |
| 2 | 2 59 33 | +89 20 58 | 3 00 24 | +89 21 06 | 3 00 54 | +89 21 17 | 3 00 56 | +89 21 28 |
| 3 | 2 59 35 | +89 20 59 | 3 00 25 | +89 21 07 | 3 00 55 | +89 21 17 | 3 00 56 | +89 21 28 |
| 4 | 2 59 37 | +89 20 59 | 3 00 26 | +89 21 07 | 3 00 55 | +89 21 18 | 3 00 56 | +89 21 29 |
| 5 | 2 59 39 | +89 20 59 | 3 00 27 | +89 21 07 | 3 00 56 | +89 21 18 | 3 00 56 | +89 21 29 |
| 6 | 2 59 40 | +89 20 59 | 3 00 28 | +89 21 07 | 3 00 57 | +89 21 18 | 3 00 56 | +89 21 29 |
| 7 | 2 59 42 | +89 20 60 | 3 00 29 | +89 21 08 | 3 00 57 | +89 21 19 | 3 00 55 | +89 21 30 |
| 8 | 2 59 43 | +89 20 60 | 3 00 31 | +89 21 08 | 3 00 58 | +89 21 19 | 3 00 54 | +89 21 30 |
| 9 | 2 59 45 | +89 20 60 | 3 00 32 | +89 21 08 | 3 00 59 | +89 21 19 | 3 00 54 | +89 21 31 |
| 10 | 2 59 47 | +89 21 00 | 3 00 34 | +89 21 09 | 3 00 59 | +89 21 20 | 3 00 53 | +89 21 31 |
| 11 | 2 59 49 | +89 21 00 | 3 00 35 | +89 21 09 | 3 00 59 | +89 21 20 | 3 00 52 | +89 21 31 |
| 12 | 2 59 51 | +89 21 01 | 3 00 37 | +89 21 09 | 3 00 59 | +89 21 21 | 3 00 50 | +89 21 32 |
| 13 | 2 59 53 | +89 21 01 | 3 00 38 | +89 21 10 | 3 00 59 | +89 21 21 | 3 00 49 | +89 21 32 |
| 14 | 2 59 55 | +89 21 01 | 3 00 39 | +89 21 10 | 3 00 59 | +89 21 22 | 3 00 49 | +89 21 32 |
| 15 | 2 59 57 | +89 21 01 | 3 00 40 | +89 21 10 | 3 00 59 | +89 21 22 | 3 00 48 | +89 21 32 |
| 16 | 2 59 59 | +89 21 02 | 3 00 41 | +89 21 11 | 3 00 59 | +89 21 22 | 3 00 47 | +89 21 33 |
| 17 | 3 00 01 | +89 21 02 | 3 00 42 | +89 21 11 | 3 00 59 | +89 21 23 | 3 00 46 | +89 21 33 |
| 18 | 3 00 02 | +89 21 02 | 3 00 43 | +89 21 12 | 3 00 59 | +89 21 23 | 3 00 45 | +89 21 33 |
| 19 | 3 00 03 | +89 21 02 | 3 00 43 | +89 21 12 | 3 00 59 | +89 21 23 | 3 00 45 | +89 21 34 |
| 20 | 3 00 05 | +89 21 03 | 3 00 44 | +89 21 12 | 3 00 60 | +89 21 24 | 3 00 44 | +89 21 34 |
| 21 | 3 00 06 | +89 21 03 | 3 00 45 | +89 21 13 | 3 00 60 | +89 21 24 | 3 00 43 | +89 21 34 |
| 22 | 3 00 08 | +89 21 03 | 3 00 46 | +89 21 13 | 3 00 60 | +89 21 24 | 3 00 42 | +89 21 35 |
| 23 | 3 00 09 | +89 21 04 | 3 00 47 | +89 21 13 | 3 00 60 | +89 21 25 | 3 00 41 | +89 21 35 |
| 24 | 3 00 11 | +89 21 04 | 3 00 48 | +89 21 13 | 3 00 60 | +89 21 25 | 3 00 39 | +89 21 35 |
| 25 | 3 00 12 | +89 21 04 | 3 00 49 | +89 21 14 | 3 00 60 | +89 21 25 | 3 00 38 | +89 21 36 |
| 26 | 3 00 14 | +89 21 04 | 3 00 50 | +89 21 14 | 3 00 59 | +89 21 26 | 3 00 36 | +89 21 36 |
| 27 | 3 00 16 | +89 21 05 | 3 00 51 | +89 21 15 | 3 00 59 | +89 21 26 | 3 00 35 | +89 21 36 |
| 28 | 3 00 18 | +89 21 05 | 3 00 52 | +89 21 15 | 3 00 58 | +89 21 27 | 3 00 33 | +89 21 36 |
| 29 | 3 00 19 | +89 21 05 | 3 00 53 | +89 21 15 | 3 00 58 | +89 21 27 | 3 00 32 | +89 21 36 |
| 30 | 3 00 21 | +89 21 05 | 3 00 53 | +89 21 16 | 3 00 57 | +89 21 27 | 3 00 31 | +89 21 37 |
| 31 | | | 3 00 54 | +89 21 16 | | | 3 00 30 | +89 21 37 |
| 32 | | | | | | | 3 00 29 | +89 21 37 |

## POLARIS TABLE, 2021

| LST | $0^h$ | | $1^h$ | | $2^h$ | | $3^h$ | | $4^h$ | | $5^h$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $a_0$ | $b_0$ | $a_0$ | $b_0$ | $a_0$ | $b_0$ | $a_0$ | $b_0$ | $a_0$ | $b_0$ | $a_0$ | $b_0$ |
| m | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ |
| 0 | -27.5 | +27.5 | -33.7 | +19.4 | -37.5 | +9.9 | -38.8 | -0.2 | -37.4 | -10.4 | -33.4 | -19.8 |
| 3 | 27.8 | 27.2 | 33.9 | 19.0 | 37.6 | 9.4 | 38.8 | 0.8 | 37.3 | 10.9 | 33.2 | 20.3 |
| 6 | 28.2 | 26.8 | 34.2 | 18.5 | 37.8 | 8.9 | 38.8 | 1.3 | 37.1 | 11.4 | 32.9 | 20.7 |
| 9 | 28.5 | 26.4 | 34.4 | 18.1 | 37.9 | 8.4 | 38.8 | 1.8 | 37.0 | 11.9 | 32.6 | 21.1 |
| 12 | 28.9 | 26.0 | 34.6 | 17.6 | 38.0 | 7.9 | 38.7 | 2.3 | 36.8 | 12.4 | 32.3 | 21.6 |
| 15 | -29.2 | +25.7 | -34.9 | +17.1 | -38.1 | +7.4 | -38.7 | -2.8 | -36.6 | -12.9 | -32.0 | -22.0 |
| 18 | 29.6 | 25.3 | 35.1 | 16.7 | 38.2 | 6.9 | 38.7 | 3.3 | 36.5 | 13.3 | 31.8 | 22.4 |
| 21 | 29.9 | 24.9 | 35.3 | 16.2 | 38.3 | 6.4 | 38.6 | 3.8 | 36.3 | 13.8 | 31.5 | 22.8 |
| 24 | 30.2 | 24.5 | 35.5 | 15.8 | 38.4 | 5.9 | 38.6 | 4.4 | 36.1 | 14.3 | 31.2 | 23.2 |
| 27 | 30.5 | 24.1 | 35.7 | 15.3 | 38.4 | 5.4 | 38.5 | 4.9 | 35.9 | 14.8 | 30.8 | 23.7 |
| 30 | -30.8 | +23.7 | -35.9 | +14.8 | -38.5 | +4.9 | -38.4 | -5.4 | -35.7 | -15.3 | -30.5 | -24.1 |
| 33 | 31.1 | 23.3 | 36.1 | 14.3 | 38.6 | 4.4 | 38.4 | 5.9 | 35.5 | 15.7 | 30.2 | 24.5 |
| 36 | 31.4 | 22.9 | 36.3 | 13.9 | 38.6 | 3.9 | 38.3 | 6.4 | 35.3 | 16.2 | 29.9 | 24.9 |
| 39 | 31.7 | 22.4 | 36.5 | 13.4 | 38.7 | 3.4 | 38.2 | 6.9 | 35.1 | 16.7 | 29.6 | 25.3 |
| 42 | 32.0 | 22.0 | 36.6 | 12.9 | 38.7 | 2.8 | 38.1 | 7.4 | 34.9 | 17.1 | 29.2 | 25.6 |
| 45 | -32.3 | +21.6 | -36.8 | +12.4 | -38.7 | +2.3 | -38.0 | -7.9 | -34.6 | -17.6 | -28.9 | -26.0 |
| 48 | 32.6 | 21.2 | 36.9 | 11.9 | 38.8 | 1.8 | 37.9 | 8.4 | 34.4 | 18.0 | 28.6 | 26.4 |
| 51 | 32.9 | 20.7 | 37.1 | 11.4 | 38.8 | 1.3 | 37.8 | 8.9 | 34.2 | 18.5 | 28.2 | 26.8 |
| 54 | 33.1 | 20.3 | 37.2 | 10.9 | 38.8 | 0.8 | 37.7 | 9.4 | 33.9 | 18.9 | 27.9 | 27.1 |
| 57 | 33.4 | 19.9 | 37.4 | 10.4 | 38.8 | +0.3 | 37.5 | 9.9 | 33.7 | 19.4 | 27.5 | 27.5 |
| 60 | -33.7 | +19.4 | -37.5 | +9.9 | -38.8 | -0.2 | -37.4 | -10.4 | -33.4 | -19.8 | -27.1 | -27.9 |
| Lat. ° | $a_1$ | $b_1$ | $a_1$ | $b_1$ | $a_1$ | $b_1$ | $a_1$ | $b_1$ | $a_1$ | $b_1$ | $a_1$ | $b_1$ |
| 0 | -.1 | -.3 | -.1 | -.2 | .0 | -.1 | .0 | .0 | .0 | +.1 | -.1 | +.2 |
| 10 | -.1 | -.2 | -.1 | -.2 | .0 | -.1 | .0 | .0 | .0 | +.1 | -.1 | +.2 |
| 20 | -.1 | -.2 | .0 | -.2 | .0 | -.1 | .0 | .0 | .0 | +.1 | .0 | +.2 |
| 30 | -.1 | -.1 | .0 | -.1 | .0 | -.1 | .0 | .0 | .0 | +.1 | .0 | +.1 |
| 40 | .0 | -.1 | .0 | -.1 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | +.1 |
| 45 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 |
| 50 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 |
| 55 | .0 | +.1 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 |
| 60 | +.1 | +.1 | .0 | +.1 | .0 | +.1 | .0 | .0 | .0 | -.1 | .0 | -.1 |
| 62 | +.1 | +.2 | .0 | +.1 | .0 | +.1 | .0 | .0 | .0 | -.1 | .0 | -.1 |
| 64 | +.1 | +.2 | .0 | +.2 | .0 | +.1 | .0 | .0 | .0 | -.1 | .0 | -.2 |
| 66 | +.1 | +.2 | +.1 | +.2 | .0 | +.1 | .0 | .0 | .0 | -.1 | +.1 | -.2 |
| Month | $a_2$ | $b_2$ | $a_2$ | $b_2$ | $a_2$ | $b_2$ | $a_2$ | $b_2$ | $a_2$ | $b_2$ | $a_2$ | $b_2$ |
| Jan. | +.2 | -.1 | +.2 | -.1 | +.2 | .0 | +.2 | .0 | +.2 | +.1 | +.1 | +.1 |
| Feb. | +.1 | -.2 | +.1 | -.2 | +.2 | -.2 | +.2 | -.1 | +.2 | -.1 | +.3 | .0 |
| Mar. | -.1 | -.3 | .0 | -.3 | +.1 | -.3 | +.2 | -.3 | +.2 | -.2 | +.3 | -.2 |
| Apr. | -.2 | -.3 | -.1 | -.3 | -.1 | -.4 | .0 | -.3 | +.1 | -.3 | +.2 | -.3 |
| May | -.3 | -.2 | -.3 | -.2 | -.2 | -.3 | -.1 | -.3 | .0 | -.4 | +.1 | -.4 |
| June | -.3 | .0 | -.3 | -.1 | -.3 | -.2 | -.2 | -.3 | -.2 | -.3 | -.1 | -.3 |
| July | -.3 | +.1 | -.3 | .0 | -.3 | .0 | -.3 | -.1 | -.3 | -.2 | -.2 | -.2 |
| Aug. | -.1 | +.2 | -.2 | +.2 | -.2 | +.1 | -.3 | +.1 | -.3 | .0 | -.3 | -.1 |
| Sept. | .0 | +.3 | .0 | +.3 | -.1 | +.3 | -.2 | +.2 | -.2 | +.2 | -.3 | +.1 |
| Oct. | +.2 | +.3 | +.2 | +.3 | +.1 | +.3 | .0 | +.3 | -.1 | +.3 | -.2 | +.3 |
| Nov. | +.4 | +.2 | +.3 | +.3 | +.3 | +.3 | +.2 | +.4 | +.1 | +.4 | -.1 | +.4 |
| Dec. | +.5 | .0 | +.5 | +.2 | +.4 | +.3 | +.3 | +.4 | +.2 | +.4 | +.1 | +.5 |

Latitude = Corrected observed altitude of *Polaris* + $a_0 + a_1 + a_2$

Azimuth of *Polaris* = $(b_0 + b_1 + b_2)$/ cos (latitude)

## POLARIS TABLE, 2021

| LST | $6^h$ | | $7^h$ | | $8^h$ | | $9^h$ | | $10^h$ | | $11^h$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $a_0$ | $b_0$ | $a_0$ | $b_0$ | $a_0$ | $b_0$ | $a_0$ | $b_0$ | $a_0$ | $b_0$ | $a_0$ | $b_0$ |
| m | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ |
| 0 | -27.1 | -27.9 | -19.0 | -33.9 | -9.6 | -37.7 | +0.5 | -38.8 | +10.5 | -37.3 | +19.8 | -33.3 |
| 3 | 26.8 | 28.2 | 18.5 | 34.2 | 9.1 | 37.8 | 1.0 | 38.8 | 11.0 | 37.1 | 20.2 | 33.0 |
| 6 | 26.4 | 28.6 | 18.1 | 34.4 | 8.6 | 37.9 | 1.5 | 38.8 | 11.5 | 37.0 | 20.7 | 32.7 |
| 9 | 26.0 | 28.9 | 17.6 | 34.7 | 8.1 | 38.0 | 2.0 | 38.7 | 12.0 | 36.8 | 21.1 | 32.4 |
| 12 | 25.6 | 29.3 | 17.2 | 34.9 | 7.6 | 38.1 | 2.5 | 38.7 | 12.5 | 36.7 | 21.5 | 32.2 |
| 15 | -25.3 | -29.6 | -16.7 | -35.1 | -7.1 | -38.2 | +3.0 | -38.7 | +12.9 | -36.5 | +21.9 | -31.9 |
| 18 | 24.9 | 29.9 | 16.3 | 35.3 | 6.6 | 38.3 | 3.5 | 38.6 | 13.4 | 36.3 | 22.3 | 31.6 |
| 21 | 24.5 | 30.2 | 15.8 | 35.5 | 6.1 | 38.4 | 4.0 | 38.6 | 13.9 | 36.1 | 22.8 | 31.3 |
| 24 | 24.1 | 30.6 | 15.3 | 35.7 | 5.6 | 38.4 | 4.6 | 38.5 | 14.4 | 36.0 | 23.2 | 31.0 |
| 27 | 23.7 | 30.9 | 14.9 | 35.9 | 5.1 | 38.5 | 5.1 | 38.4 | 14.8 | 35.8 | 23.6 | 30.7 |
| 30 | -23.3 | -31.2 | -14.4 | -36.1 | -4.6 | -38.6 | +5.6 | -38.4 | +15.3 | -35.6 | +24.0 | -30.4 |
| 33 | 22.9 | 31.5 | 13.9 | 36.3 | 4.1 | 38.6 | 6.1 | 38.3 | 15.8 | 35.4 | 24.4 | 30.1 |
| 36 | 22.4 | 31.8 | 13.5 | 36.5 | 3.6 | 38.7 | 6.6 | 38.2 | 16.2 | 35.2 | 24.8 | 29.7 |
| 39 | 22.0 | 32.1 | 13.0 | 36.7 | 3.1 | 38.7 | 7.1 | 38.1 | 16.7 | 34.9 | 25.1 | 29.4 |
| 42 | 21.6 | 32.4 | 12.5 | 36.8 | 2.5 | 38.7 | 7.6 | 38.0 | 17.1 | 34.7 | 25.5 | 29.1 |
| 45 | -21.2 | -32.6 | -12.0 | -37.0 | -2.0 | -38.8 | +8.1 | -37.9 | +17.6 | -34.5 | +25.9 | -28.8 |
| 48 | 20.7 | 32.9 | 11.5 | 37.1 | 1.5 | 38.8 | 8.6 | 37.8 | 18.0 | 34.2 | 26.3 | 28.4 |
| 51 | 20.3 | 33.2 | 11.0 | 37.3 | 1.0 | 38.8 | 9.0 | 37.7 | 18.5 | 34.0 | 26.7 | 28.1 |
| 54 | 19.9 | 33.4 | 10.5 | 37.4 | -0.5 | 38.8 | 9.5 | 37.5 | 18.9 | 33.8 | 27.0 | 27.7 |
| 57 | 19.4 | 33.7 | 10.1 | 37.5 | 0.0 | 38.8 | 10.0 | 37.4 | 19.4 | 33.5 | 27.4 | 27.4 |
| 60 | -19.0 | -33.9 | -9.6 | -37.7 | +0.5 | -38.8 | +10.5 | -37.3 | +19.8 | -33.3 | +27.7 | -27.0 |
| Lat. | $a_1$ | $b_1$ | $a_1$ | $b_1$ | $a_1$ | $b_1$ | $a_1$ | $b_1$ | $a_1$ | $b_1$ | $a_1$ | $b_1$ |
| ° | | | | | | | | | | | | |
| 0 | -.1 | +.3 | -.2 | +.2 | -.2 | +.1 | -.3 | .0 | -.2 | -.1 | -.2 | -.2 |
| 10 | -.1 | +.2 | -.2 | +.2 | -.2 | +.1 | -.2 | .0 | -.2 | -.1 | -.2 | -.2 |
| 20 | -.1 | +.2 | -.1 | +.2 | -.2 | +.1 | -.2 | .0 | -.2 | -.1 | -.1 | -.2 |
| 30 | -.1 | +.1 | -.1 | +.1 | -.1 | +.1 | -.1 | .0 | -.1 | -.1 | -.1 | -.1 |
| 40 | .0 | +.1 | -.1 | +.1 | -.1 | .0 | -.1 | .0 | -.1 | .0 | -.1 | -.1 |
| 45 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 |
| 50 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 |
| 55 | .0 | -.1 | .0 | .0 | .0 | .0 | +.1 | .0 | .0 | .0 | .0 | .0 |
| 60 | +.1 | -.1 | +.1 | -.1 | +.1 | -.1 | +.1 | .0 | +.1 | +.1 | +.1 | +.1 |
| 62 | +.1 | -.2 | +.1 | -.1 | +.1 | -.1 | +.2 | .0 | +.1 | +.1 | +.1 | +.1 |
| 64 | +.1 | -.2 | +.1 | -.2 | +.2 | -.1 | +.2 | .0 | +.2 | +.1 | +.1 | +.2 |
| 66 | +.1 | -.2 | +.2 | -.2 | +.2 | -.1 | +.2 | .0 | +.2 | +.1 | +.2 | +.2 |
| Month | $a_2$ | $b_2$ | $a_2$ | $b_2$ | $a_2$ | $b_2$ | $a_2$ | $b_2$ | $a_2$ | $b_2$ | $a_2$ | $b_2$ |
| Jan. | +.1 | +.2 | +.1 | +.2 | .0 | +.2 | .0 | +.2 | -.1 | +.2 | -.1 | +.1 |
| Feb. | +.2 | +.1 | +.2 | +.1 | +.2 | +.2 | +.1 | +.2 | +.1 | +.2 | .0 | +.3 |
| Mar. | +.3 | -.1 | +.3 | -+.1 | +.3 | +.1 | +.3 | +.2 | +.2 | +.2 | +.2 | +.3 |
| Apr. | +.3 | -.2 | +.3 | -.2 | +.4 | -.1 | +.4 | .0 | +.3 | +.1 | +.3 | +.2 |
| May | +.2 | -.3 | +.2 | -.3 | +.3 | -.2 | +.3 | -.1 | +.4 | .0 | +.4 | +.1 |
| June | .0 | -.3 | +.1 | -.3 | +.2 | -.3 | +.3 | -.2 | +.3 | -.2 | +.3 | -.1 |
| July | -.1 | -.3 | .0 | -.3 | .0 | -.3 | +.1 | -.3 | +.2 | -.3 | +.2 | -.2 |
| Aug. | -.2 | -.1 | -.2 | -.1 | -.1 | -.2 | -.1 | -.3 | .0 | -.3 | +.1 | -.3 |
| Sept. | -.3 | .0 | -.3 | .0 | -.3 | -.1 | -.2 | -.2 | -.2 | -.2 | -.1 | -.3 |
| Oct. | -.3 | +.2 | -.3 | +.2 | -.3 | +.1 | -.4 | .0 | -.3 | -.1 | -.3 | -.2 |
| Nov. | -.2 | +.4 | -.3 | +.4 | -.3 | +.3 | -.4 | +.2 | -.4 | +.1 | -.4 | -.1 |
| Dec. | .0 | +.5 | -.2 | +.5 | -.3 | +.4 | -.4 | +.3 | -.4 | +.2 | -.5 | +.1 |

Latitude = Corrected observed altitude of *Polaris* + $a_0$ + $a_1$ + $a_2$

Azimuth of *Polaris* = ($b_0$ + $b_1$ + $b_2$)/ cos (latitude)

## POLARIS TABLE, 2021

| LST | $12^{h}$ | | $13^{h}$ | | $14^{h}$ | | $15^{h}$ | | $16^{h}$ | | $17^{h}$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $a_0$ | $b_0$ | $a_0$ | $b_0$ | $a_0$ | $b_0$ | $a_0$ | $b_0$ | $a_0$ | $b_0$ | $a_0$ | $b_0$ |
| m | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ |
| 0 | +27.7 | -27.0 | +33.8 | -19.0 | +37.6 | -9.7 | +38.8 | +0.2 | +37.4 | +10.1 | +33.5 | +19.4 |
| 3 | 28.1 | 26.6 | 34.0 | 18.5 | 37.7 | 9.2 | 38.8 | 0.7 | 37.3 | 10.6 | 33.3 | 19.8 |
| 6 | 28.4 | 26.3 | 34.3 | 18.1 | 37.8 | 8.7 | 38.8 | 1.2 | 37.2 | 11.1 | 33.0 | 20.2 |
| 9 | 28.8 | 25.9 | 34.5 | 17.6 | 37.9 | 8.2 | 38.8 | 1.7 | 37.0 | 11.6 | 32.8 | 20.7 |
| 12 | 29.1 | 25.5 | 34.7 | 17.2 | 38.0 | 7.7 | 38.7 | 2.2 | 36.9 | 12.1 | 32.5 | 21.1 |
| 15 | +29.4 | -25.1 | +35.0 | -16.7 | +38.1 | -7.2 | +38.7 | +2.7 | +36.7 | +12.5 | +32.2 | +21.5 |
| 18 | 29.8 | 24.8 | 35.2 | 16.3 | 38.2 | 6.7 | 38.7 | 3.2 | 36.5 | 13.0 | 31.9 | 21.9 |
| 21 | 30.1 | 24.4 | 35.4 | 15.8 | 38.3 | 6.2 | 38.6 | 3.7 | 36.3 | 13.5 | 31.6 | 22.3 |
| 24 | 30.4 | 24.0 | 35.6 | 15.4 | 38.4 | 5.8 | 38.6 | 4.2 | 36.2 | 14.0 | 31.3 | 22.8 |
| 27 | 30.7 | 23.6 | 35.8 | 14.9 | 38.4 | 5.3 | 38.5 | 4.7 | 36.0 | 14.4 | 31.0 | 23.2 |
| 30 | +31.0 | -23.2 | +36.0 | -14.4 | +38.5 | -4.8 | +38.4 | +5.2 | +35.8 | +14.9 | +30.7 | +23.6 |
| 33 | 31.3 | 22.8 | 36.2 | 14.0 | 38.6 | 4.3 | 38.4 | 5.7 | 35.6 | 15.3 | 30.4 | 24.0 |
| 36 | 31.6 | 22.4 | 36.3 | 13.5 | 38.6 | 3.8 | 38.3 | 6.2 | 35.4 | 15.8 | 30.1 | 24.3 |
| 39 | 31.9 | 22.0 | 36.5 | 13.0 | 38.7 | 3.3 | 38.2 | 6.7 | 35.2 | 16.3 | 29.8 | 24.7 |
| 42 | 32.2 | 21.5 | 36.7 | 12.6 | 38.7 | 2.8 | 38.1 | 7.2 | 35.0 | 16.7 | 29.5 | 25.1 |
| 45 | +32.5 | -21.1 | +36.8 | -12.1 | +38.7 | -2.3 | +38.0 | +7.7 | +34.7 | +17.2 | +29.1 | +25.5 |
| 48 | 32.7 | 20.7 | 37.0 | 11.6 | 38.8 | 1.8 | 37.9 | 8.2 | 34.5 | 17.6 | 28.8 | 25.9 |
| 51 | 33.0 | 20.3 | 37.1 | 11.1 | 38.8 | 1.3 | 37.8 | 8.7 | 34.3 | 18.1 | 28.4 | 26.3 |
| 54 | 33.3 | 19.8 | 37.3 | 10.6 | 38.8 | 0.8 | 37.7 | 9.2 | 34.0 | 18.5 | 28.1 | 26.6 |
| 57 | 33.5 | 19.4 | 37.4 | 10.2 | 38.8 | -0.3 | 37.6 | 9.7 | 33.8 | 18.9 | 27.8 | 27.0 |
| 60 | +33.8 | -19.0 | +37.6 | -9.7 | +38.8 | +0.2 | +37.4 | +10.1 | +33.5 | +19.4 | +27.4 | +27.3 |
| Lat. | $a_1$ | $b_1$ | $a_1$ | $b_1$ | $a_1$ | $b_1$ | $a_1$ | $b_1$ | $a_1$ | $b_1$ | $a_1$ | $b_1$ |
| ° | | | | | | | | | | | | |
| 0 | -.1 | -.3 | -.1 | -.2 | .0 | -.1 | .0 | .0 | .0 | +.1 | -.1 | +.2 |
| 10 | -.1 | -.2 | -.1 | -.2 | .0 | -.1 | .0 | .0 | .0 | +.1 | -.1 | +.2 |
| 20 | -.1 | -.2 | .0 | -.2 | .0 | -.1 | .0 | .0 | .0 | +.1 | .0 | +.2 |
| 30 | -.1 | -.1 | .0 | -.1 | .0 | -.1 | .0 | .0 | .0 | +.1 | .0 | +.1 |
| 40 | .0 | -.1 | .0 | -.1 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | +.1 |
| 45 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 |
| 50 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 |
| 55 | .0 | +.1 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 |
| 60 | +.1 | +.1 | .0 | +.1 | .0 | +.1 | .0 | .0 | .0 | -.1 | .0 | -.1 |
| 62 | +.1 | +.2 | .0 | +.1 | .0 | +.1 | .0 | .0 | .0 | -.1 | .0 | -.1 |
| 64 | +.1 | +.2 | .0 | +.2 | .0 | +.1 | .0 | .0 | .0 | -.1 | .0 | -.2 |
| 66 | +.1 | +.2 | +.1 | +.2 | .0 | +.1 | .0 | .0 | .0 | -.1 | +.1 | -.2 |
| Month | $a_2$ | $b_2$ | $a_2$ | $b_2$ | $a_2$ | $b_2$ | $a_2$ | $b_2$ | $a_2$ | $b_2$ | $a_2$ | $b_2$ |
| Jan. | -.2 | +.1 | -.2 | +.1 | -.2 | .0 | -.2 | .0 | -.2 | -.1 | -.1 | -.1 |
| Feb. | -.1 | +.2 | -.1 | +.2 | -.2 | +.2 | -.2 | +.1 | -.2 | +.1 | -.3 | .0 |
| Mar. | +.1 | +.3 | .0 | +.3 | -.1 | +.3 | -.2 | +.3 | -.2 | +.2 | -.3 | +.2 |
| Apr. | +.2 | +.3 | +.1 | +.3 | +.1 | +.4 | .0 | +.4 | -.1 | +.3 | -.2 | +.3 |
| May | +.3 | +.2 | +.3 | +.2 | +.2 | +.3 | +.1 | +.3 | .0 | +.4 | -.1 | +.4 |
| June | +.3 | .0 | +.3 | +.1 | +.3 | +.2 | +.2 | +.3 | +.2 | +.3 | +.1 | +.3 |
| July | +.3 | -.1 | +.3 | .0 | +.3 | .0 | +.3 | +.1 | +.3 | +.2 | +.2 | +.2 |
| Aug. | +.1 | -.2 | +.2 | -.2 | +.2 | -.1 | +.3 | -.1 | +.3 | .0 | +.3 | +.1 |
| Sept. | .0 | -.3 | .0 | -.3 | +.1 | -.3 | +.2 | -.2 | +.2 | -.2 | +.3 | -.1 |
| Oct. | -.2 | -.3 | -.2 | -.3 | -.1 | -.3 | .0 | -.4 | +.1 | -.3 | +.2 | -.3 |
| Nov. | -.4 | -.2 | -.3 | -.3 | -.3 | -.3 | -.2 | -.4 | -.1 | -.4 | +.1 | -.4 |
| Dec. | -.5 | .0 | -.5 | -.2 | -.4 | -.3 | -.3 | -.4 | -.2 | -.4 | -.1 | -.5 |

Latitude = Corrected observed altitude of *Polaris* + $a_0 + a_1 + a_2$

Azimuth of *Polaris* = $(b_0 + b_1 + b_2)/\cos(\text{latitude})$

**POLARIS TABLE, 2021**

| LST | $18^h$ | | $19^h$ | | $20^h$ | | $21^h$ | | $22^h$ | | $23^h$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $a_0$ | $b_0$ | $a_0$ | $b_0$ | $a_0$ | $b_0$ | $a_0$ | $b_0$ | $a_0$ | $b_0$ | $a_0$ | $b_0$ |
| m | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ |
| 0 | +27.4 | +27.3 | +19.4 | +33.5 | +10.1 | +37.4 | +0.0 | +38.8 | -10.0 | +37.5 | -19.4 | +33.7 |
| 3 | 27.0 | 27.7 | 18.9 | 33.7 | 9.6 | 37.5 | -0.5 | 38.8 | 10.5 | 37.4 | 19.9 | 33.5 |
| 6 | 26.7 | 28.0 | 18.5 | 34.0 | 9.1 | 37.7 | 1.0 | 38.8 | 11.0 | 37.3 | 20.3 | 33.2 |
| 9 | 26.3 | 28.4 | 18.1 | 34.2 | 8.6 | 37.8 | 1.5 | 38.8 | 11.5 | 37.1 | 20.7 | 32.9 |
| 12 | 25.9 | 28.7 | 17.6 | 34.5 | 8.1 | 37.9 | 2.0 | 38.8 | 12.0 | 37.0 | 21.2 | 32.6 |
| 15 | +25.5 | +29.1 | +17.2 | +34.7 | +07.6 | +38.0 | -2.5 | +38.7 | -12.5 | +36.8 | -21.6 | +32.4 |
| 18 | 25.2 | 29.4 | 16.7 | 34.9 | 7.1 | 38.1 | 3.0 | 38.7 | 12.9 | 36.7 | 22.0 | 32.1 |
| 21 | 24.8 | 29.7 | 16.2 | 35.1 | 6.6 | 38.2 | 3.5 | 38.7 | 13.4 | 36.5 | 22.4 | 31.8 |
| 24 | 24.4 | 30.0 | 15.8 | 35.4 | 6.1 | 38.3 | 4.0 | 38.6 | 13.9 | 36.3 | 22.8 | 31.5 |
| 27 | 24.0 | 30.4 | 15.3 | 35.6 | 5.6 | 38.4 | 4.5 | 38.6 | 14.4 | 36.1 | 23.2 | 31.2 |
| 30 | +23.6 | +30.7 | +14.8 | +35.8 | +5.1 | +38.4 | -5.0 | +38.5 | -14.8 | +35.9 | -23.6 | +30.9 |
| 33 | 23.2 | 31.0 | 14.4 | 35.9 | 4.6 | 38.5 | 5.6 | 38.4 | 15.3 | 35.7 | 24.0 | 30.6 |
| 36 | 22.8 | 31.3 | 13.9 | 36.1 | 4.1 | 38.6 | 6.1 | 38.4 | 15.8 | 35.5 | 24.4 | 30.3 |
| 39 | 22.4 | 31.6 | 13.4 | 36.3 | 3.6 | 38.6 | 6.6 | 38.3 | 16.2 | 35.3 | 24.8 | 29.9 |
| 42 | 22.0 | 31.9 | 13.0 | 36.5 | 3.1 | 38.7 | 7.1 | 38.2 | 16.7 | 35.1 | 25.2 | 29.6 |
| 45 | +21.5 | +32.2 | +12.5 | +36.7 | +2.6 | +38.7 | -7.6 | +38.1 | -17.2 | +34.9 | -25.6 | +29.3 |
| 48 | 21.1 | 32.4 | 12.0 | 36.8 | 2.1 | 38.7 | 8.1 | 38.0 | 17.6 | 34.7 | 26.0 | 28.9 |
| 51 | 20.7 | 32.7 | 11.5 | 37.0 | 1.5 | 38.8 | 8.5 | 37.9 | 18.1 | 34.4 | 26.4 | 28.6 |
| 54 | 20.3 | 33.0 | 11.0 | 37.1 | 1.0 | 38.8 | 9.0 | 37.8 | 18.5 | 34.2 | 26.7 | 28.2 |
| 57 | 19.8 | 33.2 | 10.5 | 37.3 | 0.5 | 38.8 | 9.5 | 37.7 | 19.0 | 34.0 | 27.1 | 27.9 |
| 60 | +19.4 | 33.5 | +10.1 | +37.4 | +0.0 | +38.8 | -10.0 | +37.5 | -19.4 | +33.7 | -27.5 | +27.5 |
| Lat. ° | $a_1$ | $b_1$ | $a_1$ | $b_1$ | $a_1$ | $b_1$ | $a_1$ | $b_1$ | $a_1$ | $b_1$ | $a_1$ | $b_1$ |
| 0 | -.1 | +.3 | -.2 | +.2 | -.2 | +.1 | -.3 | .0 | -.2 | -.1 | -.2 | -.2 |
| 10 | -.1 | +.2 | -.2 | +.2 | -.2 | +.1 | -.2 | .0 | -.2 | -.1 | -.2 | -.2 |
| 20 | -.1 | +.2 | -.1 | +.2 | -.2 | +.1 | -.2 | .0 | -.2 | -.1 | -.1 | -.2 |
| 30 | -.1 | +.1 | -.1 | +.1 | -.1 | +.1 | -.1 | .0 | -.1 | -.1 | -.1 | -.1 |
| 40 | .0 | +.1 | -.1 | +.1 | -.1 | .0 | -.1 | .0 | -.1 | .0 | -.1 | -.1 |
| 45 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 |
| 50 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 |
| 55 | .0 | -.1 | .0 | .0 | .0 | .0 | +.1 | .0 | .0 | .0 | .0 | .0 |
| 60 | +.1 | -.1 | +.1 | -.1 | +.1 | -.1 | +.1 | .0 | +.1 | +.1 | +.1 | +.1 |
| 62 | +.1 | -.2 | +.1 | -.1 | +.1 | -.1 | +.2 | .0 | +.1 | +.1 | +.1 | +.1 |
| 64 | +.1 | -.2 | +.1 | -.2 | +.2 | -.1 | +.2 | .0 | +.2 | +.1 | +.1 | +.2 |
| 66 | +.1 | -.2 | +.2 | -.2 | +.2 | -.1 | +.2 | .0 | +.2 | +.1 | +.2 | +.2 |
| Month | $a_2$ | $b_2$ | $a_2$ | $b_2$ | $a_2$ | $b_2$ | $a_2$ | $b_2$ | $a_2$ | $b_2$ | $a_2$ | $b_2$ |
| Jan. | -.1 | -.2 | -.1 | -.2 | .0 | -.2 | .0 | -.2 | +.1 | -.2 | +.1 | -.1 |
| Feb. | -.2 | -.1 | -.2 | -.1 | -.2 | -.2 | -.1 | -.2 | -.1 | -.2 | .0 | -.3 |
| Mar. | -.3 | +.1 | -.3 | .0 | -.3 | -.1 | -.3 | -.2 | -.2 | -.2 | -.2 | -.3 |
| Apr. | -.3 | +.2 | -.3 | +.1 | -.4 | +.1 | -.4 | .0 | -.3 | -.1 | -.3 | -.2 |
| May | -.2 | +.3 | -.2 | +.3 | -.3 | +.2 | -.3 | +.1 | -.4 | .0 | -.4 | -.1 |
| June | .0 | +.3 | -.1 | +.3 | -.2 | +.3 | -.3 | +.2 | -.3 | +.2 | -.3 | +.1 |
| July | +.1 | +.3 | .0 | +.3 | .0 | +.3 | -.1 | +.3 | -.2 | +.3 | -.2 | +.2 |
| Aug. | +.2 | +.1 | +.2 | +.2 | +.1 | +.2 | +.1 | +.3 | .0 | +.3 | -.1 | +.3 |
| Sept. | +.3 | .0 | +.3 | .0 | +.3 | +.1 | +.2 | +.2 | +.2 | +.2 | +.1 | +.3 |
| Oct. | +.3 | -.2 | +.3 | -.2 | +.3 | -.1 | +.4 | .0 | +.3 | +.1 | +.3 | +.2 |
| Nov. | +.2 | -.4 | +.3 | -.3 | +.3 | -.3 | +.4 | -.2 | +.4 | -.1 | +.4 | +.1 |
| Dec. | .0 | -.5 | +.2 | -.5 | +.3 | -.4 | +.4 | -.3 | +.4 | -.2 | +.5 | -.1 |

Latitude = Corrected observed altitude of *Polaris* + $a_0$ + $a_1$ + $a_2$
Azimuth of *Polaris* = ($b_0$ + $b_1$ + $b_2$)/ cos (latitude)

# PART - III

## SUNRISE, SUNSET AND MOONRISE, MOONSET

## SUNRISE, 2021

LOCAL MEAN TIME OF SUNRISE (SUN'S UPPER LIMB) AND BEGINNING OF MORNING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian. In India, to obtain I.S.T., add 4 x ( 82º.5 - $\lambda$ ) mins. or deduct 4 x ( $\lambda$ - 82º.5 ) mins. as the station is west or east of 82º.5 E. Longitude.

| Date \ Lat. | 0º | 10º | 20º | 30º | 35º | 40º | 45º | 50º | 52º | 54º | 56º | 58º | 60º |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m |
| Jan. 1 | 6 00 | 6 17 | 6 35 | 6 56 | 7 08 | 7 22 | 7 38 | 7 58 | 8 08 | 8 19 | 8 31 | 8 45 | 9 02 |
| 5 | 6 02 | 6 19 | 6 36 | 6 57 | 7 08 | 7 22 | 7 38 | 7 58 | 8 07 | 8 18 | 8 29 | 8 43 | 8 59 |
| 9 | 6 04 | 6 20 | 6 37 | 6 57 | 7 08 | 7 22 | 7 37 | 7 56 | 8 05 | 8 15 | 8 27 | 8 40 | 8 55 |
| 13 | 6 05 | 6 21 | 6 38 | 6 57 | 7 08 | 7 21 | 7 36 | 7 54 | 8 03 | 8 12 | 8 23 | 8 36 | 8 50 |
| 17 | 6 07 | 6 22 | 6 38 | 6 56 | 7 07 | 7 19 | 7 33 | 7 51 | 7 59 | 8 08 | 8 19 | 8 30 | 8 44 |
| 21 | 6 08 | 6 22 | 6 38 | 6 55 | 7 05 | 7 17 | 7 31 | 7 47 | 7 55 | 8 03 | 8 13 | 8 24 | 8 37 |
| 25 | 6 09 | 6 23 | 6 37 | 6 54 | 7 03 | 7 14 | 7 27 | 7 43 | 7 50 | 7 58 | 8 07 | 8 17 | 8 29 |
| 29 | 6 10 | 6 23 | 6 36 | 6 52 | 7 01 | 7 11 | 7 23 | 7 37 | 7 44 | 7 52 | 8 00 | 8 09 | 8 20 |
| Feb. 2 | 6 10 | 6 22 | 6 35 | 6 50 | 6 58 | 7 07 | 7 18 | 7 32 | 7 38 | 7 45 | 7 53 | 8 01 | 8 11 |
| 6 | 6 11 | 6 22 | 6 34 | 6 47 | 6 55 | 7 03 | 7 13 | 7 26 | 7 31 | 7 38 | 7 45 | 7 52 | 8 01 |
| 10 | 6 11 | 6 21 | 6 32 | 6 44 | 6 51 | 6 59 | 7 08 | 7 19 | 7 24 | 7 30 | 7 36 | 7 43 | 7 51 |
| 14 | 6 11 | 6 20 | 6 30 | 6 41 | 6 47 | 6 54 | 7 02 | 7 12 | 7 17 | 7 22 | 7 27 | 7 33 | 7 40 |
| 18 | 6 11 | 6 19 | 6 27 | 6 37 | 6 43 | 6 49 | 6 56 | 7 05 | 7 09 | 7 13 | 7 18 | 7 23 | 7 29 |
| 22 | 6 10 | 6 17 | 6 25 | 6 33 | 6 38 | 6 43 | 6 50 | 6 57 | 7 00 | 7 04 | 7 08 | 7 13 | 7 18 |
| 26 | 6 10 | 6 16 | 6 22 | 6 29 | 6 33 | 6 38 | 6 43 | 6 49 | 6 52 | 6 55 | 6 59 | 7 02 | 7 07 |
| Mar. 2 | 6 09 | 6 14 | 6 19 | 6 25 | 6 28 | 6 32 | 6 36 | 6 41 | 6 43 | 6 46 | 6 49 | 6 52 | 6 55 |
| 6 | 6 08 | 6 12 | 6 16 | 6 20 | 6 23 | 6 26 | 6 29 | 6 33 | 6 34 | 6 36 | 6 38 | 6 41 | 6 43 |
| 10 | 6 07 | 6 10 | 6 13 | 6 16 | 6 17 | 6 19 | 6 22 | 6 24 | 6 25 | 6 27 | 6 28 | 6 30 | 6 31 |
| 14 | 6 06 | 6 08 | 6 09 | 6 11 | 6 12 | 6 13 | 6 14 | 6 16 | 6 16 | 6 17 | 6 18 | 6 18 | 6 19 |
| 18 | 6 05 | 6 05 | 6 06 | 6 06 | 6 06 | 6 07 | 6 07 | 6 07 | 6 07 | 6 07 | 6 07 | 6 07 | 6 07 |
| 22 | 6 04 | 6 03 | 6 02 | 6 01 | 6 01 | 6 00 | 5 59 | 5 58 | 5 58 | 5 57 | 5 57 | 5 56 | 5 55 |
| 26 | 6 02 | 6 01 | 5 59 | 5 57 | 5 55 | 5 54 | 5 52 | 5 50 | 5 48 | 5 47 | 5 46 | 5 45 | 5 43 |
| 30 | 6 01 | 5 58 | 5 55 | 5 52 | 5 50 | 5 47 | 5 44 | 5 41 | 5 39 | 5 37 | 5 36 | 5 33 | 5 31 |
| Apr. 3 | 6 00 | 5 56 | 5 52 | 5 47 | 5 44 | 5 41 | 5 37 | 5 32 | 5 30 | 5 28 | 5 25 | 5 22 | 5 19 |

BEGINNING OF MORNING TWILIGHT

| Date | 0º | 10º | 20º | 30º | 35º | 40º | 45º | 50º | 52º | 54º | 56º | 58º | 60º |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m |
| Jan. 1 | 4 45 | 5 02 | 5 17 | 5 31 | 5 38 | 5 45 | 5 52 | 6 00 | 6 03 | 6 06 | 6 10 | 6 14 | 6 18 |
| 9 | 4 49 | 5 05 | 5 19 | 5 32 | 5 39 | 5 45 | 5 52 | 5 59 | 6 02 | 6 05 | 6 08 | 6 12 | 6 15 |
| 17 | 4 53 | 5 08 | 5 21 | 5 32 | 5 38 | 5 44 | 5 50 | 5 55 | 5 58 | 6 00 | 6 03 | 6 06 | 6 09 |
| 25 | 4 56 | 5 09 | 5 21 | 5 31 | 5 36 | 5 40 | 5 45 | 5 49 | 5 51 | 5 53 | 5 55 | 5 57 | 5 59 |
| Feb. 2 | 4 58 | 5 10 | 5 20 | 5 28 | 5 31 | 5 35 | 5 38 | 5 41 | 5 42 | 5 43 | 5 44 | 5 44 | 5 45 |
| 10 | 5 00 | 5 09 | 5 17 | 5 23 | 5 25 | 5 27 | 5 29 | 5 30 | 5 30 | 5 30 | 5 30 | 5 29 | 5 29 |
| 18 | 5 00 | 5 08 | 5 13 | 5 17 | 5 18 | 5 18 | 5 18 | 5 17 | 5 16 | 5 15 | 5 13 | 5 12 | 5 10 |
| 26 | 5 00 | 5 05 | 5 08 | 5 09 | 5 09 | 5 08 | 5 05 | 5 02 | 5 00 | 4 58 | 4 55 | 4 52 | 4 48 |
| Mar. 6 | 4 59 | 5 02 | 5 03 | 5 01 | 4 59 | 4 56 | 4 51 | 4 45 | 4 42 | 4 39 | 4 34 | 4 30 | 4 24 |
| 14 | 4 57 | 4 58 | 4 56 | 4 52 | 4 48 | 4 43 | 4 36 | 4 27 | 4 23 | 4 18 | 4 12 | 4 05 | 3 57 |
| 22 | 4 55 | 4 53 | 4 49 | 4 42 | 4 36 | 4 29 | 4 20 | 4 08 | 4 02 | 3 56 | 3 48 | 3 39 | 3 28 |
| 30 | 4 52 | 4 48 | 4 42 | 4 31 | 4 24 | 4 15 | 4 03 | 3 48 | 3 40 | 3 32 | 3 21 | 3 10 | 2 55 |

## SUNSET, 2021

LOCAL MEAN TIME OF SUNSET (SUN'S UPPER LIMB) AND ENDING
OF EVENING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian. In India, to obtain I.S.T., add 4 x ( 82º.5 - $\lambda$ ) mins. or deduct 4 x ( $\lambda$ - 82º.5 ) mins. as the station is west or east of 82º.5 E. Longitude**.**

| Date \ Lat. | 0º | 10º | 20º | 30º | 35º | 40º | 45º | 50º | 52º | 54º | 56º | 58º | 60º |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m |
| Jan. 1 | 18 07 | 17 50 | 17 32 | 17 12 | 16 59 | 16 46 | 16 29 | 16 09 | 15 59 | 15 49 | 15 36 | 15 22 | 15 05 |
| 5 | 18 09 | 17 53 | 17 35 | 17 14 | 17 03 | 16 49 | 16 33 | 16 13 | 16 04 | 15 54 | 15 42 | 15 28 | 15 12 |
| 9 | 18 11 | 17 55 | 17 37 | 17 18 | 17 06 | 16 53 | 16 38 | 16 18 | 16 09 | 15 59 | 15 48 | 15 35 | 15 19 |
| 13 | 18 12 | 17 57 | 17 40 | 17 21 | 17 10 | 16 57 | 16 42 | 16 24 | 16 15 | 16 06 | 15 55 | 15 42 | 15 28 |
| 17 | 18 14 | 17 59 | 17 43 | 17 24 | 17 14 | 17 02 | 16 47 | 16 30 | 16 22 | 16 13 | 16 02 | 15 51 | 15 37 |
| 21 | 18 15 | 18 01 | 17 45 | 17 28 | 17 18 | 17 06 | 16 53 | 16 36 | 16 28 | 16 20 | 16 10 | 15 59 | 15 47 |
| 25 | 18 16 | 18 02 | 17 48 | 17 31 | 17 22 | 17 11 | 16 58 | 16 43 | 16 36 | 16 27 | 16 18 | 16 08 | 15 57 |
| 29 | 18 17 | 18 04 | 17 50 | 17 35 | 17 26 | 17 16 | 17 04 | 16 49 | 16 43 | 16 35 | 16 27 | 16 18 | 16 07 |
| Feb. 2 | 18 17 | 18 05 | 17 53 | 17 38 | 17 30 | 17 20 | 17 09 | 16 56 | 16 50 | 16 43 | 16 36 | 16 27 | 16 17 |
| 6 | 18 18 | 18 06 | 17 55 | 17 42 | 17 34 | 17 25 | 17 15 | 17 03 | 16 58 | 16 51 | 16 44 | 16 37 | 16 28 |
| 10 | 18 18 | 18 08 | 17 57 | 17 45 | 17 38 | 17 30 | 17 21 | 17 10 | 17 05 | 16 59 | 16 53 | 16 46 | 16 38 |
| 14 | 18 18 | 18 08 | 17 59 | 17 48 | 17 42 | 17 35 | 17 27 | 17 17 | 17 12 | 17 08 | 17 02 | 16 56 | 16 49 |
| 18 | 18 17 | 18 09 | 18 01 | 17 51 | 17 46 | 17 40 | 17 32 | 17 24 | 17 20 | 17 16 | 17 11 | 17 05 | 17 00 |
| 22 | 18 17 | 18 10 | 18 02 | 17 54 | 17 49 | 17 44 | 17 38 | 17 31 | 17 27 | 17 24 | 17 19 | 17 15 | 17 10 |
| 26 | 18 16 | 18 10 | 18 04 | 17 57 | 17 53 | 17 49 | 17 43 | 17 37 | 17 35 | 17 31 | 17 28 | 17 24 | 17 20 |
| Mar. 2 | 18 15 | 18 11 | 18 05 | 18 00 | 17 57 | 17 53 | 17 49 | 17 44 | 17 42 | 17 39 | 17 37 | 17 34 | 17 30 |
| 6 | 18 14 | 18 11 | 18 07 | 18 03 | 18 00 | 17 57 | 17 54 | 17 51 | 17 49 | 17 47 | 17 45 | 17 43 | 17 40 |
| 10 | 18 13 | 18 11 | 18 08 | 18 05 | 18 04 | 18 02 | 18 00 | 17 57 | 17 56 | 17 55 | 17 53 | 17 52 | 17 50 |
| 14 | 18 12 | 18 11 | 18 09 | 18 08 | 18 07 | 18 06 | 18 05 | 18 04 | 18 03 | 18 02 | 18 02 | 18 01 | 18 00 |
| 18 | 18 11 | 18 11 | 18 11 | 18 10 | 18 10 | 18 10 | 18 10 | 18 10 | 18 10 | 18 10 | 18 10 | 18 10 | 18 10 |
| 22 | 18 10 | 18 11 | 18 12 | 18 13 | 18 13 | 18 14 | 18 15 | 18 16 | 18 17 | 18 18 | 18 18 | 18 19 | 18 20 |
| 26 | 18 09 | 18 11 | 18 13 | 18 15 | 18 17 | 18 18 | 18 20 | 18 23 | 18 24 | 18 25 | 18 26 | 18 28 | 18 30 |
| 30 | 18 08 | 18 11 | 18 14 | 18 18 | 18 20 | 18 22 | 18 25 | 18 29 | 18 31 | 18 33 | 18 35 | 18 37 | 18 39 |
| Apr. 3 | 18 06 | 18 10 | 18 15 | 18 20 | 18 23 | 18 26 | 18 30 | 18 35 | 18 38 | 18 40 | 18 43 | 18 46 | 18 49 |

### END OF EVENING TWILIGHT

| Date | 0º | 10º | 20º | 30º | 35º | 40º | 45º | 50º | 52º | 54º | 56º | 58º | 60º |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m |
| Jan. 1 | 19 22 | 19 06 | 18 51 | 18 37 | 18 30 | 18 23 | 18 16 | 18 08 | 18 05 | 18 01 | 17 58 | 17 54 | 17 50 |
| 9 | 19 25 | 19 09 | 18 55 | 18 42 | 18 36 | 18 29 | 18 23 | 18 16 | 18 13 | 18 10 | 18 07 | 18 03 | 18 00 |
| 17 | 19 27 | 19 13 | 19 00 | 18 48 | 18 42 | 18 37 | 18 31 | 18 25 | 18 23 | 18 20 | 18 18 | 18 15 | 18 12 |
| 25 | 19 29 | 19 15 | 19 04 | 18 54 | 18 49 | 18 45 | 18 40 | 18 36 | 18 34 | 18 33 | 18 31 | 18 29 | 18 27 |
| Feb. 2 | 19 29 | 19 18 | 19 08 | 19 00 | 18 56 | 18 53 | 18 50 | 18 48 | 18 47 | 18 46 | 18 45 | 18 44 | 18 43 |
| 10 | 19 29 | 19 19 | 19 12 | 19 06 | 19 03 | 19 02 | 19 00 | 19 00 | 18 59 | 19 00 | 19 00 | 19 00 | 19 01 |
| 18 | 19 27 | 19 20 | 19 15 | 19 11 | 19 10 | 19 10 | 19 11 | 19 12 | 19 13 | 19 14 | 19 16 | 19 17 | 19 20 |
| 26 | 19 26 | 19 20 | 19 17 | 19 17 | 19 17 | 19 19 | 19 21 | 19 25 | 19 27 | 19 29 | 19 32 | 19 35 | 19 39 |
| Mar. 6 | 19 23 | 19 21 | 19 20 | 19 22 | 19 24 | 19 27 | 19 32 | 19 38 | 19 42 | 19 45 | 19 50 | 19 55 | 20 00 |
| 14 | 19 21 | 19 21 | 19 22 | 19 27 | 19 31 | 19 36 | 19 43 | 19 52 | 19 57 | 20 02 | 20 08 | 20 15 | 20 23 |
| 22 | 19 19 | 19 21 | 19 25 | 19 33 | 19 38 | 19 45 | 19 55 | 20 07 | 20 13 | 20 20 | 20 28 | 20 37 | 20 48 |
| 30 | 19 16 | 19 21 | 19 28 | 19 38 | 19 46 | 19 55 | 20 07 | 20 23 | 20 30 | 20 39 | 20 50 | 21 02 | 21 17 |

## SUNRISE, 2021

LOCAL MEAN TIME OF SUNRISE (SUN'S UPPER LIMB) AND BEGINNING OF MORNING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian. In India, to obtain I.S.T., add 4 x ( 82º.5 - λ ) mins. or deduct 4 x ( λ - 82º.5 ) mins. as the station is west or east of 82º.5 E. Longitude.

| Date \ Lat. | 0º | 10º | 20º | 30º | 35º | 40º | 45º | 50º | 52º | 54º | 56º | 58º | 60º |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m |
| Apr. 7 | 5 59 | 5 54 | 5 48 | 5 42 | 5 39 | 5 34 | 5 30 | 5 24 | 5 21 | 5 18 | 5 15 | 5 11 | 5 07 |
| 11 | 5 58 | 5 52 | 5 45 | 5 38 | 5 33 | 5 28 | 5 22 | 5 15 | 5 12 | 5 08 | 5 04 | 5 00 | 4 55 |
| 15 | 5 57 | 5 50 | 5 42 | 5 33 | 5 28 | 5 22 | 5 15 | 5 07 | 5 03 | 4 59 | 4 54 | 4 49 | 4 43 |
| 19 | 5 56 | 5 48 | 5 39 | 5 29 | 5 23 | 5 16 | 5 08 | 4 59 | 4 54 | 4 50 | 4 44 | 4 38 | 4 31 |
| 23 | 5 55 | 5 46 | 5 36 | 5 25 | 5 18 | 5 11 | 5 02 | 4 51 | 4 46 | 4 41 | 4 34 | 4 28 | 4 20 |
| 27 | 5 54 | 5 44 | 5 33 | 5 21 | 5 13 | 5 05 | 4 55 | 4 43 | 4 38 | 4 32 | 4 25 | 4 17 | 4 09 |
| May 1 | 5 54 | 5 43 | 5 31 | 5 17 | 5 09 | 5 00 | 4 49 | 4 36 | 4 30 | 4 23 | 4 16 | 4 07 | 3 58 |
| 5 | 5 53 | 5 41 | 5 29 | 5 14 | 5 05 | 4 55 | 4 44 | 4 29 | 4 23 | 4 15 | 4 07 | 3 58 | 3 47 |
| 9 | 5 53 | 5 40 | 5 27 | 5 11 | 5 01 | 4 51 | 4 38 | 4 23 | 4 16 | 4 08 | 3 59 | 3 48 | 3 37 |
| 13 | 5 53 | 5 39 | 5 25 | 5 08 | 4 58 | 4 47 | 4 33 | 4 17 | 4 09 | 4 00 | 3 51 | 3 40 | 3 27 |
| 17 | 5 53 | 5 39 | 5 23 | 5 05 | 4 55 | 4 43 | 4 29 | 4 11 | 4 03 | 3 54 | 3 43 | 3 31 | 3 17 |
| 21 | 5 53 | 5 38 | 5 22 | 5 03 | 4 52 | 4 40 | 4 25 | 4 06 | 3 58 | 3 48 | 3 37 | 3 24 | 3 09 |
| 25 | 5 53 | 5 38 | 5 21 | 5 02 | 4 50 | 4 37 | 4 21 | 4 02 | 3 53 | 3 42 | 3 31 | 3 17 | 3 01 |
| 29 | 5 54 | 5 38 | 5 20 | 5 00 | 4 48 | 4 35 | 4 18 | 3 58 | 3 49 | 3 38 | 3 25 | 3 11 | 2 54 |
| Jun. 2 | 5 54 | 5 38 | 5 20 | 4 59 | 4 47 | 4 33 | 4 16 | 3 55 | 3 45 | 3 34 | 3 21 | 3 06 | 2 48 |
| 6 | 5 55 | 5 38 | 5 20 | 4 59 | 4 46 | 4 32 | 4 14 | 3 53 | 3 42 | 3 31 | 3 17 | 3 02 | 2 43 |
| 10 | 5 56 | 5 39 | 5 20 | 4 58 | 4 46 | 4 31 | 4 13 | 3 51 | 3 41 | 3 29 | 3 15 | 2 59 | 2 39 |
| 14 | 5 57 | 5 39 | 5 20 | 4 58 | 4 46 | 4 31 | 4 13 | 3 50 | 3 40 | 3 27 | 3 13 | 2 57 | 2 37 |
| 18 | 5 58 | 5 40 | 5 21 | 4 59 | 4 46 | 4 31 | 4 13 | 3 50 | 3 39 | 3 27 | 3 13 | 2 56 | 2 36 |
| 22 | 5 58 | 5 41 | 5 22 | 5 00 | 4 47 | 4 32 | 4 14 | 3 51 | 3 40 | 3 28 | 3 14 | 2 57 | 2 36 |
| 26 | 5 59 | 5 42 | 5 23 | 5 01 | 4 48 | 4 33 | 4 15 | 3 52 | 3 42 | 3 29 | 3 15 | 2 58 | 2 38 |
| 30 | 6 00 | 5 43 | 5 24 | 5 02 | 4 49 | 4 35 | 4 17 | 3 55 | 3 44 | 3 32 | 3 18 | 3 01 | 2 41 |
| July 4 | 6 01 | 5 44 | 5 25 | 5 04 | 4 51 | 4 37 | 4 19 | 3 57 | 3 47 | 3 35 | 3 21 | 3 05 | 2 46 |
| 8 | 6 02 | 5 45 | 5 27 | 5 06 | 4 53 | 4 39 | 4 22 | 4 01 | 3 50 | 3 39 | 3 26 | 3 10 | 2 52 |

BEGINNING OF MORNING TWILIGHT

| Date | 0º | 10º | 20º | 30º | 35º | 40º | 45º | 50º | 52º | 54º | 56º | 58º | 60º |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m |
| Apr. 7 | 4 50 | 4 43 | 4 34 | 4 20 | 4 11 | 4 00 | 3 46 | 3 27 | 3 17 | 3 06 | 2 53 | 2 37 | 2 17 |
| 15 | 4 47 | 4 38 | 4 27 | 4 10 | 3 59 | 3 45 | 3 28 | 3 04 | 2 52 | 2 38 | 2 21 | 1 59 | 1 29 |
| 23 | 4 45 | 4 34 | 4 19 | 4 00 | 3 47 | 3 31 | 3 10 | 2 41 | 2 26 | 2 08 | 1 44 | 1 08 | |
| May 1 | 4 42 | 4 30 | 4 13 | 3 50 | 3 35 | 3 17 | 2 52 | 2 17 | 1 57 | 1 32 | 0 51 | | |
| 9 | 4 41 | 4 26 | 4 07 | 3 42 | 3 25 | 3 03 | 2 35 | 1 52 | 1 25 | 0 41 | | | |
| 17 | 4 40 | 4 23 | 4 03 | 3 34 | 3 15 | 2 51 | 2 18 | 1 24 | 0 41 | | | | |
| 25 | 4 40 | 4 22 | 3 59 | 3 28 | 3 08 | 2 41 | 2 04 | 0 52 | | | | | |
| June 2 | 4 40 | 4 21 | 3 57 | 3 24 | 3 02 | 2 34 | 1 51 | | | | | | |
| 10 | 4 41 | 4 21 | 3 56 | 3 22 | 2 59 | 2 29 | 1 43 | | | | | | |
| 18 | 4 42 | 4 22 | 3 57 | 3 22 | 2 59 | 2 28 | 1 40 | | | | | | |
| 26 | 4 44 | 4 24 | 3 59 | 3 24 | 3 01 | 2 30 | 1 42 | | | | | | |
| July 4 | 4 46 | 4 26 | 4 02 | 3 28 | 3 05 | 2 35 | 1 50 | | | | | | |

## SUNSET, 2021

LOCAL MEAN TIME OF SUNSET (SUN'S UPPER LIMB) AND ENDING
OF EVENING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian. In India, to obtain I.S.T., add 4 x ( 82º.5 - λ ) mins. or deduct 4 x ( λ - 82º.5 ) mins. as the station is west or east of 82º.5 E. Longitude**.**

| Date \ Lat. | | 0º | 10º | 20º | 30º | 35º | 40º | 45º | 50º | 52º | 54º | 56º | 58º | 60º |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m |
| Apr. | 7 | 18 05 | 18 10 | 18 16 | 18 22 | 18 26 | 18 30 | 18 35 | 18 42 | 18 44 | 18 47 | 18 51 | 18 55 | 18 59 |
| | 11 | 18 04 | 18 10 | 18 17 | 18 25 | 18 29 | 18 35 | 18 41 | 18 48 | 18 51 | 18 55 | 18 59 | 19 04 | 19 09 |
| | 15 | 18 03 | 18 11 | 18 18 | 18 27 | 18 33 | 18 39 | 18 46 | 18 54 | 18 58 | 19 02 | 19 07 | 19 13 | 19 19 |
| | 19 | 18 02 | 18 11 | 18 20 | 18 30 | 18 36 | 18 43 | 18 51 | 19 00 | 19 05 | 19 10 | 19 15 | 19 21 | 19 29 |
| | 23 | 18 02 | 18 11 | 18 21 | 18 32 | 18 39 | 18 47 | 18 56 | 19 07 | 19 12 | 19 17 | 19 23 | 19 30 | 19 38 |
| | 27 | 18 01 | 18 11 | 18 22 | 18 35 | 18 42 | 18 51 | 19 01 | 19 13 | 19 18 | 19 25 | 19 32 | 19 39 | 19 48 |
| May | 1 | 18 00 | 18 12 | 18 24 | 18 37 | 18 46 | 18 55 | 19 06 | 19 19 | 19 25 | 19 32 | 19 40 | 19 48 | 19 58 |
| | 5 | 18 00 | 18 12 | 18 25 | 18 40 | 18 49 | 18 59 | 19 11 | 19 25 | 19 32 | 19 39 | 19 48 | 19 57 | 20 08 |
| | 9 | 18 00 | 18 13 | 18 27 | 18 43 | 18 52 | 19 03 | 19 15 | 19 31 | 19 38 | 19 46 | 19 56 | 20 06 | 20 18 |
| | 13 | 18 00 | 18 13 | 18 28 | 18 45 | 18 55 | 19 07 | 19 20 | 19 37 | 19 45 | 19 53 | 20 03 | 20 15 | 20 28 |
| | 17 | 18 00 | 18 14 | 18 30 | 18 48 | 18 58 | 19 10 | 19 25 | 19 42 | 19 51 | 20 00 | 20 11 | 20 23 | 20 37 |
| | 21 | 18 00 | 18 15 | 18 31 | 18 50 | 19 01 | 19 14 | 19 29 | 19 48 | 19 57 | 20 07 | 20 18 | 20 31 | 20 46 |
| | 25 | 18 01 | 18 16 | 18 33 | 18 53 | 19 04 | 19 17 | 19 33 | 19 53 | 20 02 | 20 13 | 20 24 | 20 38 | 20 55 |
| | 29 | 18 01 | 18 17 | 18 35 | 18 55 | 19 07 | 19 21 | 19 37 | 19 57 | 20 07 | 20 18 | 20 31 | 20 45 | 21 02 |
| June | 2 | 18 02 | 18 18 | 18 36 | 18 57 | 19 09 | 19 24 | 19 40 | 20 02 | 20 12 | 20 23 | 20 36 | 20 51 | 21 10 |
| | 6 | 18 02 | 18 19 | 18 38 | 18 59 | 19 12 | 19 26 | 19 44 | 20 05 | 20 16 | 20 27 | 20 41 | 20 57 | 21 16 |
| | 10 | 18 03 | 18 20 | 18 39 | 19 01 | 19 14 | 19 28 | 19 46 | 20 08 | 20 19 | 20 31 | 20 45 | 21 01 | 21 21 |
| | 14 | 18 04 | 18 21 | 18 40 | 19 02 | 19 15 | 19 30 | 19 48 | 20 11 | 20 21 | 20 34 | 20 48 | 21 04 | 21 25 |
| | 18 | 18 05 | 18 22 | 18 41 | 19 03 | 19 17 | 19 32 | 19 50 | 20 12 | 20 23 | 20 35 | 20 50 | 21 06 | 21 27 |
| | 22 | 18 06 | 18 23 | 18 42 | 19 04 | 19 17 | 19 33 | 19 51 | 20 13 | 20 24 | 20 36 | 20 51 | 21 07 | 21 28 |
| | 26 | 18 07 | 18 24 | 18 43 | 19 05 | 19 18 | 19 33 | 19 51 | 20 13 | 20 24 | 20 36 | 20 50 | 21 07 | 21 27 |
| | 30 | 18 07 | 18 25 | 18 43 | 19 05 | 19 18 | 19 33 | 19 51 | 20 13 | 20 23 | 20 35 | 20 49 | 21 06 | 21 25 |
| July | 4 | 18 08 | 18 25 | 18 44 | 19 05 | 19 18 | 19 32 | 19 50 | 20 11 | 20 22 | 20 33 | 20 47 | 21 03 | 21 22 |
| | 8 | 18 09 | 18 25 | 18 44 | 19 04 | 19 17 | 19 31 | 19 48 | 20 09 | 20 19 | 20 31 | 20 44 | 20 59 | 21 17 |

END OF EVENING TWILIGHT

| | | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Apr. | 7 | 19 15 | 19 21 | 19 31 | 19 44 | 19 54 | 20 05 | 20 20 | 20 39 | 20 49 | 21 01 | 21 14 | 21 30 | 21 51 |
| | 15 | 19 13 | 19 22 | 19 34 | 19 51 | 20 02 | 20 16 | 20 34 | 20 58 | 21 10 | 21 24 | 21 42 | 22 05 | 22 38 |
| | 23 | 19 12 | 19 23 | 19 38 | 19 57 | 20 11 | 20 27 | 20 48 | 21 18 | 21 33 | 21 52 | 22 17 | 22 56 | |
| May | 1 | 19 12 | 19 25 | 19 42 | 20 05 | 20 20 | 20 39 | 21 04 | 21 40 | 22 00 | 22 27 | 23 12 | | |
| | 9 | 19 12 | 19 27 | 19 46 | 20 12 | 20 29 | 20 51 | 21 20 | 22 04 | 22 32 | 23 22 | | | |
| | 17 | 19 13 | 19 30 | 19 51 | 20 19 | 20 38 | 21 02 | 21 36 | 22 32 | 23 19 | | | | |
| | 25 | 19 14 | 19 32 | 19 55 | 20 26 | 20 47 | 21 14 | 21 52 | 23 06 | | | | | |
| June | 2 | 19 16 | 19 35 | 19 59 | 20 32 | 20 54 | 21 23 | 22 06 | | | | | | |
| | 10 | 19 18 | 19 38 | 20 03 | 20 37 | 21 00 | 21 31 | 22 17 | | | | | | |
| | 18 | 19 20 | 19 40 | 20 06 | 20 40 | 21 04 | 21 35 | 22 23 | | | | | | |
| | 26 | 19 22 | 19 42 | 20 07 | 20 41 | 21 05 | 21 36 | 22 23 | | | | | | |
| July | 4 | 19 23 | 19 42 | 20 07 | 20 41 | 21 03 | 21 33 | 22 18 | | | | | | |

## SUNRISE, 2021

LOCAL MEAN TIME OF SUNRISE (SUN'S UPPER LIMB) AND BEGINNING
OF MORNING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian. In India, to obtain I.S.T., add 4 x ( 82º.5 - λ ) mins. or deduct 4 x ( λ - 82º.5 ) mins. as the station is west or east of 82º.5 E. Longitude.

| Date \ Lat. | | 0º | 10º | 20º | 30º | 35º | 40º | 45º | 50º | 52º | 54º | 56º | 58º | 60º |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m |
| July | 12 | 6 02 | 5 46 | 5 28 | 5 08 | 4 56 | 4 42 | 4 25 | 4 05 | 3 55 | 3 44 | 3 31 | 3 16 | 2 58 |
| | 16 | 6 03 | 5 47 | 5 30 | 5 10 | 4 58 | 4 45 | 4 29 | 4 09 | 3 59 | 3 49 | 3 37 | 3 23 | 3 06 |
| | 20 | 6 03 | 5 48 | 5 31 | 5 12 | 5 01 | 4 48 | 4 33 | 4 14 | 4 05 | 3 54 | 3 43 | 3 30 | 3 14 |
| | 24 | 6 03 | 5 48 | 5 33 | 5 14 | 5 04 | 4 51 | 4 37 | 4 19 | 4 10 | 4 01 | 3 50 | 3 37 | 3 23 |
| | 28 | 6 03 | 5 49 | 5 34 | 5 17 | 5 07 | 4 55 | 4 41 | 4 24 | 4 16 | 4 07 | 3 57 | 3 45 | 3 32 |
| Aug. | 1 | 6 03 | 5 50 | 5 36 | 5 19 | 5 10 | 4 58 | 4 45 | 4 30 | 4 22 | 4 14 | 4 04 | 3 54 | 3 41 |
| | 5 | 6 03 | 5 50 | 5 37 | 5 22 | 5 13 | 5 02 | 4 50 | 4 35 | 4 28 | 4 21 | 4 12 | 4 02 | 3 51 |
| | 9 | 6 02 | 5 51 | 5 38 | 5 24 | 5 16 | 5 06 | 4 55 | 4 41 | 4 35 | 4 27 | 4 20 | 4 11 | 4 00 |
| | 13 | 6 01 | 5 51 | 5 39 | 5 26 | 5 19 | 5 10 | 4 59 | 4 47 | 4 41 | 4 35 | 4 27 | 4 19 | 4 10 |
| | 17 | 6 01 | 5 51 | 5 41 | 5 29 | 5 22 | 5 14 | 5 04 | 4 53 | 4 48 | 4 42 | 4 35 | 4 28 | 4 19 |
| | 21 | 6 00 | 5 51 | 5 42 | 5 31 | 5 25 | 5 17 | 5 09 | 4 59 | 4 54 | 4 49 | 4 43 | 4 36 | 4 29 |
| | 25 | 5 59 | 5 51 | 5 43 | 5 33 | 5 28 | 5 21 | 5 14 | 5 05 | 5 01 | 4 56 | 4 51 | 4 45 | 4 39 |
| | 29 | 5 58 | 5 51 | 5 44 | 5 35 | 5 31 | 5 25 | 5 19 | 5 11 | 5 07 | 5 03 | 4 59 | 4 54 | 4 48 |
| Sept. | 2 | 5 56 | 5 51 | 5 45 | 5 38 | 5 33 | 5 29 | 5 23 | 5 17 | 5 14 | 5 10 | 5 06 | 5 02 | 4 58 |
| | 6 | 5 55 | 5 50 | 5 46 | 5 40 | 5 36 | 5 33 | 5 28 | 5 23 | 5 20 | 5 17 | 5 14 | 5 11 | 5 07 |
| | 10 | 5 54 | 5 50 | 5 46 | 5 42 | 5 39 | 5 36 | 5 33 | 5 29 | 5 27 | 5 24 | 5 22 | 5 19 | 5 16 |
| | 14 | 5 52 | 5 50 | 5 47 | 5 44 | 5 42 | 5 40 | 5 38 | 5 35 | 5 33 | 5 32 | 5 30 | 5 28 | 5 26 |
| | 18 | 5 51 | 5 50 | 5 48 | 5 46 | 5 45 | 5 44 | 5 42 | 5 41 | 5 40 | 5 39 | 5 38 | 5 37 | 5 35 |
| | 22 | 5 49 | 5 49 | 5 49 | 5 48 | 5 48 | 5 48 | 5 47 | 5 47 | 5 46 | 5 46 | 5 46 | 5 45 | 5 45 |
| | 26 | 5 48 | 5 49 | 5 50 | 5 51 | 5 51 | 5 51 | 5 52 | 5 53 | 5 53 | 5 53 | 5 53 | 5 54 | 5 54 |
| | 30 | 5 47 | 5 49 | 5 51 | 5 53 | 5 54 | 5 55 | 5 57 | 5 59 | 5 59 | 6 00 | 6 01 | 6 02 | 6 03 |
| Oct. | 4 | 5 45 | 5 48 | 5 52 | 5 55 | 5 57 | 5 59 | 6 02 | 6 05 | 6 06 | 6 08 | 6 09 | 6 11 | 6 13 |
| | 8 | 5 44 | 5 48 | 5 53 | 5 58 | 6 00 | 6 03 | 6 07 | 6 11 | 6 13 | 6 15 | 6 17 | 6 20 | 6 23 |
| | 12 | 5 43 | 5 48 | 5 54 | 6 00 | 6 04 | 6 07 | 6 12 | 6 17 | 6 20 | 6 22 | 6 25 | 6 29 | 6 32 |

BEGINNING OF MORNING TWILIGHT

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m |
| July | 12 | 4 48 | 4 29 | 4 05 | 3 33 | 3 11 | 2 43 | 2 02 | 0 16 | | | | | |
| | 20 | 4 49 | 4 32 | 4 09 | 3 39 | 3 19 | 2 53 | 2 16 | 1 09 | | | | | |
| | 28 | 4 50 | 4 34 | 4 14 | 3 46 | 3 28 | 3 04 | 2 32 | 1 40 | 1 02 | | | | |
| Aug. | 5 | 4 51 | 4 36 | 4 18 | 3 53 | 3 36 | 3 16 | 2 48 | 2 06 | 1 41 | 1 03 | | | |
| | 13 | 4 50 | 4 38 | 4 22 | 4 00 | 3 45 | 3 27 | 3 03 | 2 29 | 2 11 | 1 47 | 1 11 | | |
| | 21 | 4 50 | 4 39 | 4 25 | 4 06 | 3 54 | 3 38 | 3 18 | 2 50 | 2 36 | 2 18 | 1 55 | 1 24 | |
| | 29 | 4 48 | 4 40 | 4 28 | 4 12 | 4 02 | 3 49 | 3 32 | 3 09 | 2 57 | 2 44 | 2 27 | 2 07 | 1 39 |
| Sept. | 6 | 4 46 | 4 40 | 4 31 | 4 18 | 4 09 | 3 59 | 3 45 | 3 26 | 3 17 | 3 06 | 2 54 | 2 38 | 2 20 |
| | 14 | 4 43 | 4 40 | 4 34 | 4 24 | 4 17 | 4 08 | 3 57 | 3 42 | 3 34 | 3 26 | 3 16 | 3 05 | 2 51 |
| | 22 | 4 41 | 4 39 | 4 36 | 4 29 | 4 23 | 4 17 | 4 08 | 3 56 | 3 51 | 3 44 | 3 37 | 3 28 | 3 18 |
| | 30 | 4 38 | 4 39 | 4 38 | 4 33 | 4 30 | 4 25 | 4 19 | 4 10 | 4 06 | 4 01 | 3 56 | 3 49 | 3 41 |
| Oct. | 8 | 4 35 | 4 38 | 4 40 | 4 38 | 4 36 | 4 33 | 4 29 | 4 23 | 4 20 | 4 17 | 4 13 | 4 08 | 4 03 |

## SUNSET, 2021

### LOCAL MEAN TIME OF SUNSET (SUN'S UPPER LIMB) AND ENDING OF EVENING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian. In India, to obtain I.S.T., add 4 x ( 82º.5 - λ ) mins. or deduct 4 x ( λ - 82º.5 ) mins. as the station is west or east of 82º.5 E. Longitude.

| Date \ Lat. | 0º | 10º | 20º | 30º | 35º | 40º | 45º | 50º | 52º | 54º | 56º | 58º | 60º |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m |
| July 12 | 18 09 | 18 26 | 18 43 | 19 04 | 19 15 | 19 29 | 19 46 | 20 06 | 20 16 | 20 27 | 20 40 | 20 54 | 21 12 |
| 16 | 18 10 | 18 25 | 18 42 | 19 02 | 19 14 | 19 27 | 19 43 | 20 03 | 20 12 | 20 23 | 20 35 | 20 48 | 21 05 |
| 20 | 18 10 | 18 25 | 18 42 | 19 00 | 19 12 | 19 24 | 19 40 | 19 58 | 20 07 | 20 17 | 20 29 | 20 42 | 20 57 |
| 24 | 18 10 | 18 25 | 18 40 | 18 58 | 19 09 | 19 21 | 19 36 | 19 54 | 20 02 | 20 11 | 20 22 | 20 34 | 20 49 |
| 28 | 18 10 | 18 24 | 18 39 | 18 56 | 19 06 | 19 18 | 19 31 | 19 48 | 19 56 | 20 05 | 20 15 | 20 26 | 20 40 |
| Aug. 1 | 18 10 | 18 23 | 18 37 | 18 53 | 19 03 | 19 14 | 19 26 | 19 42 | 19 50 | 19 58 | 20 07 | 20 18 | 20 30 |
| 5 | 18 09 | 18 22 | 18 35 | 18 50 | 18 59 | 19 09 | 19 21 | 19 36 | 19 43 | 19 50 | 19 59 | 20 09 | 20 20 |
| 9 | 18 09 | 18 20 | 18 32 | 18 47 | 18 55 | 19 04 | 19 15 | 19 29 | 19 35 | 19 42 | 19 50 | 19 59 | 20 09 |
| 13 | 18 08 | 18 19 | 18 30 | 18 43 | 18 51 | 18 59 | 19 09 | 19 22 | 19 28 | 19 34 | 19 41 | 19 49 | 19 58 |
| 17 | 18 07 | 18 17 | 18 27 | 18 39 | 18 46 | 18 54 | 19 03 | 19 14 | 19 19 | 19 25 | 19 32 | 19 39 | 19 47 |
| 21 | 18 06 | 18 15 | 18 24 | 18 35 | 18 41 | 18 48 | 18 56 | 19 06 | 19 11 | 19 16 | 19 22 | 19 28 | 19 35 |
| 25 | 18 05 | 18 13 | 18 21 | 18 30 | 18 36 | 18 42 | 18 49 | 18 58 | 19 02 | 19 07 | 19 12 | 19 17 | 19 24 |
| 29 | 18 04 | 18 11 | 18 18 | 18 26 | 18 31 | 18 36 | 18 42 | 18 50 | 18 54 | 18 57 | 19 02 | 19 07 | 19 12 |
| Sept. 2 | 18 03 | 18 08 | 18 14 | 18 21 | 18 25 | 18 30 | 18 35 | 18 42 | 18 45 | 18 48 | 18 51 | 18 55 | 19 00 |
| 6 | 18 02 | 18 06 | 18 11 | 18 16 | 18 20 | 18 23 | 18 28 | 18 33 | 18 35 | 18 38 | 18 41 | 18 44 | 18 48 |
| 10 | 18 00 | 18 03 | 18 07 | 18 11 | 18 14 | 18 17 | 18 20 | 18 24 | 18 26 | 18 28 | 18 30 | 18 33 | 18 36 |
| 14 | 17 59 | 18 01 | 18 03 | 18 06 | 18 08 | 18 10 | 18 13 | 18 15 | 18 17 | 18 18 | 18 20 | 18 22 | 18 24 |
| 18 | 17 57 | 17 58 | 18 00 | 18 01 | 18 02 | 18 04 | 18 05 | 18 07 | 18 07 | 18 08 | 18 09 | 18 10 | 18 11 |
| 22 | 17 56 | 17 56 | 17 56 | 17 56 | 17 57 | 17 57 | 17 57 | 17 58 | 17 58 | 17 58 | 17 59 | 17 59 | 17 59 |
| 26 | 17 54 | 17 53 | 17 52 | 17 51 | 17 51 | 17 50 | 17 50 | 17 49 | 17 49 | 17 48 | 17 48 | 17 48 | 17 47 |
| 30 | 17 53 | 17 51 | 17 49 | 17 47 | 17 45 | 17 44 | 17 42 | 17 40 | 17 39 | 17 39 | 17 37 | 17 36 | 17 35 |
| Oct. 4 | 17 52 | 17 49 | 17 45 | 17 42 | 17 40 | 17 37 | 17 35 | 17 32 | 17 30 | 17 29 | 17 27 | 17 25 | 17 23 |
| 8 | 17 51 | 17 46 | 17 42 | 17 37 | 17 34 | 17 31 | 17 27 | 17 23 | 17 21 | 17 19 | 17 17 | 17 14 | 17 11 |
| 12 | 17 50 | 17 44 | 17 39 | 17 32 | 17 29 | 17 25 | 17 20 | 17 15 | 17 12 | 17 09 | 17 06 | 17 03 | 16 59 |

### END OF EVENING TWILIGHT

| Date | 0º | 10º | 20º | 30º | 35º | 40º | 45º | 50º | 52º | 54º | 56º | 58º | 60º |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m |
| July 12 | 19 24 | 19 42 | 20 06 | 20 38 | 20 59 | 21 27 | 22 08 | 23 43 | | | | | |
| 20 | 19 23 | 19 41 | 20 03 | 20 33 | 20 53 | 21 19 | 21 55 | 23 00 | | | | | |
| 28 | 19 23 | 19 39 | 19 59 | 20 26 | 20 45 | 21 08 | 21 40 | 22 30 | 23 05 | | | | |
| Aug. 5 | 19 21 | 19 35 | 19 54 | 20 18 | 20 35 | 20 55 | 21 23 | 22 03 | 22 27 | 23 02 | | | |
| 13 | 19 19 | 19 31 | 19 47 | 20 09 | 20 24 | 20 42 | 21 05 | 21 38 | 21 56 | 22 19 | 22 52 | | |
| 21 | 19 17 | 19 27 | 19 40 | 19 59 | 20 12 | 20 27 | 20 47 | 21 14 | 21 28 | 21 45 | 22 07 | 22 37 | 23 35 |
| 29 | 19 14 | 19 22 | 19 33 | 19 49 | 19 59 | 20 12 | 20 29 | 20 51 | 21 02 | 21 15 | 21 31 | 21 51 | 22 18 |
| Sept. 6 | 19 11 | 19 16 | 19 25 | 19 38 | 19 46 | 19 57 | 20 11 | 20 29 | 20 38 | 20 48 | 21 01 | 21 15 | 21 33 |
| 14 | 19 07 | 19 11 | 19 17 | 19 27 | 19 34 | 19 42 | 19 53 | 20 08 | 20 15 | 20 23 | 20 32 | 20 44 | 20 57 |
| 22 | 19 05 | 19 06 | 19 09 | 19 16 | 19 21 | 19 28 | 19 36 | 19 47 | 19 53 | 19 59 | 20 07 | 20 15 | 20 25 |
| 30 | 19 02 | 19 01 | 19 02 | 19 06 | 19 09 | 19 14 | 19 20 | 19 28 | 19 32 | 19 37 | 19 43 | 19 49 | 19 56 |
| Oct. 8 | 19 00 | 18 56 | 18 55 | 18 56 | 18 58 | 19 01 | 19 05 | 19 10 | 19 13 | 19 17 | 19 20 | 19 25 | 19 30 |

**SUNRISE, 2021**

LOCAL MEAN TIME OF SUNRISE (SUN'S UPPER LIMB) AND BEGINNING OF MORNING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian. In India, to obtain I.S.T., add 4 x ( 82°.5 - $\lambda$ ) mins. or deduct 4 x ( $\lambda$ - 82°.5 ) mins. as the station is west or east of 82°.5 E. Longitude.

| Date \ Lat. | 0° | 10° | 20° | 30° | 35° | 40° | 45° | 50° | 52° | 54° | 56° | 58° | 60° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m |
| Oct. 16 | 5 42 | 5 49 | 5 55 | 6 03 | 6 07 | 6 12 | 6 17 | 6 24 | 6 27 | 6 30 | 6 34 | 6 38 | 6 42 |
| 20 | 5 41 | 5 49 | 5 57 | 6 05 | 6 10 | 6 16 | 6 22 | 6 30 | 6 34 | 6 38 | 6 42 | 6 47 | 6 52 |
| 24 | 5 41 | 5 49 | 5 58 | 6 08 | 6 14 | 6 20 | 6 28 | 6 37 | 6 41 | 6 45 | 6 50 | 6 56 | 7 02 |
| 28 | 5 40 | 5 50 | 6 00 | 6 11 | 6 17 | 6 25 | 6 33 | 6 43 | 6 48 | 6 53 | 6 59 | 7 05 | 7 12 |
| Nov. 1 | 5 40 | 5 51 | 6 02 | 6 14 | 6 21 | 6 29 | 6 39 | 6 50 | 6 55 | 7 01 | 7 07 | 7 14 | 7 23 |
| 5 | 5 40 | 5 51 | 6 03 | 6 17 | 6 25 | 6 34 | 6 44 | 6 57 | 7 02 | 7 09 | 7 16 | 7 24 | 7 33 |
| 9 | 5 40 | 5 53 | 6 06 | 6 20 | 6 29 | 6 38 | 6 50 | 7 03 | 7 09 | 7 16 | 7 24 | 7 33 | 7 43 |
| 13 | 5 41 | 5 54 | 6 08 | 6 23 | 6 33 | 6 43 | 6 55 | 7 10 | 7 17 | 7 24 | 7 33 | 7 42 | 7 53 |
| 17 | 5 41 | 5 55 | 6 10 | 6 27 | 6 36 | 6 48 | 7 00 | 7 16 | 7 24 | 7 32 | 7 41 | 7 51 | 8 03 |
| 21 | 5 42 | 5 57 | 6 12 | 6 30 | 6 40 | 6 52 | 7 06 | 7 22 | 7 30 | 7 39 | 7 49 | 8 00 | 8 13 |
| 25 | 5 43 | 5 59 | 6 15 | 6 33 | 6 44 | 6 56 | 7 11 | 7 28 | 7 37 | 7 46 | 7 56 | 8 08 | 8 22 |
| 29 | 5 45 | 6 01 | 6 17 | 6 37 | 6 48 | 7 01 | 7 16 | 7 34 | 7 43 | 7 53 | 8 04 | 8 16 | 8 31 |
| Dec 3 | 5 46 | 6 03 | 6 20 | 6 40 | 6 51 | 7 05 | 7 20 | 7 39 | 7 49 | 7 59 | 8 10 | 8 24 | 8 39 |
| 7 | 5 48 | 6 05 | 6 22 | 6 43 | 6 55 | 7 08 | 7 24 | 7 44 | 7 54 | 8 04 | 8 16 | 8 30 | 8 46 |
| 11 | 5 50 | 6 07 | 6 25 | 6 46 | 6 58 | 7 12 | 7 28 | 7 48 | 7 58 | 8 09 | 8 21 | 8 36 | 8 52 |
| 15 | 5 51 | 6 09 | 6 27 | 6 48 | 7 01 | 7 15 | 7 31 | 7 52 | 8 02 | 8 13 | 8 25 | 8 40 | 8 57 |
| 19 | 5 53 | 6 11 | 6 29 | 6 51 | 7 03 | 7 17 | 7 34 | 7 55 | 8 05 | 8 16 | 8 29 | 8 43 | 9 01 |
| 23 | 5 55 | 6 13 | 6 31 | 6 53 | 7 05 | 7 19 | 7 36 | 7 57 | 8 07 | 8 18 | 8 31 | 8 45 | 9 03 |
| 27 | 5 57 | 6 15 | 6 33 | 6 54 | 7 07 | 7 21 | 7 37 | 7 58 | 8 08 | 8 19 | 8 32 | 8 46 | 9 03 |
| 31 | 5 59 | 6 16 | 6 35 | 6 56 | 7 08 | 7 22 | 7 38 | 7 59 | 8 08 | 8 19 | 8 31 | 8 46 | 9 03 |
| 35 | 6 01 | 6 18 | 6 36 | 6 56 | 7 08 | 7 22 | 7 38 | 7 58 | 8 07 | 8 18 | 8 30 | 8 44 | 9 00 |
| 39 | 6 03 | 6 19 | 6 37 | 6 57 | 7 09 | 7 22 | 7 38 | 7 57 | 8 06 | 8 16 | 8 28 | 8 41 | 8 57 |

BEGINNING OF MORNING TWILIGHT

| Date | 0° | 10° | 20° | 30° | 35° | 40° | 45° | 50° | 52° | 54° | 56° | 58° | 60° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m |
| Oct. 16 | 4 33 | 4 38 | 4 42 | 4 43 | 4 43 | 4 41 | 4 39 | 4 36 | 4 34 | 4 32 | 4 30 | 4 27 | 4 23 |
| 24 | 4 31 | 4 38 | 4 44 | 4 48 | 4 49 | 4 49 | 4 49 | 4 48 | 4 48 | 4 47 | 4 45 | 4 44 | 4 42 |
| Nov. 1 | 4 29 | 4 39 | 4 47 | 4 53 | 4 55 | 4 57 | 4 59 | 5 00 | 5 00 | 5 00 | 5 00 | 5 00 | 5 00 |
| 9 | 4 28 | 4 40 | 4 50 | 4 58 | 5 02 | 5 05 | 5 09 | 5 12 | 5 13 | 5 14 | 5 15 | 5 16 | 5 16 |
| 17 | 4 29 | 4 42 | 4 54 | 5 04 | 5 09 | 5 13 | 5 18 | 5 23 | 5 24 | 5 26 | 5 28 | 5 30 | 5 32 |
| 25 | 4 30 | 4 45 | 4 58 | 5 10 | 5 15 | 5 21 | 5 27 | 5 33 | 5 35 | 5 38 | 5 41 | 5 43 | 5 46 |
| Dec. 3 | 4 32 | 4 48 | 5 02 | 5 15 | 5 22 | 5 28 | 5 35 | 5 42 | 5 45 | 5 48 | 5 51 | 5 55 | 5 58 |
| 11 | 4 35 | 4 51 | 5 06 | 5 20 | 5 27 | 5 34 | 5 42 | 5 50 | 5 53 | 5 56 | 6 00 | 6 04 | 6 08 |
| 19 | 4 38 | 4 55 | 5 11 | 5 25 | 5 32 | 5 40 | 5 47 | 5 55 | 5 59 | 6 02 | 6 06 | 6 10 | 6 15 |
| 27 | 4 42 | 4 59 | 5 15 | 5 29 | 5 36 | 5 43 | 5 51 | 5 59 | 6 02 | 6 06 | 6 10 | 6 14 | 6 18 |
| 35 | 4 47 | 5 03 | 5 18 | 5 31 | 5 38 | 5 45 | 5 52 | 6 00 | 6 03 | 6 06 | 6 10 | 6 13 | 6 17 |
| 43 | 4 51 | 5 06 | 5 20 | 5 33 | 5 39 | 5 45 | 5 51 | 5 58 | 6 01 | 6 04 | 6 07 | 6 10 | 6 13 |

## SUNSET, 2021

LOCAL MEAN TIME OF SUNSET (SUN'S UPPER LIMB) AND ENDING
OF EVENING TWILIGHT ON THE MERIDIAN OF GREENWICH

To obtain the standard time at any station, add four minutes for each degree if the station is west of the standard meridian, or deduct four minutes for each degree if the station is east of the standard meridian. In India, to obtain I.S.T., add 4 x ( 82º.5 - $\lambda$ ) mins. or deduct 4 x ( $\lambda$ - 82º.5 ) mins. as the station is west or east of 82º.5 E. Longitude**.**

| Date \ Lat. | 0º | 10º | 20º | 30º | 35º | 40º | 45º | 50º | 52º | 54º | 56º | 58º | 60º |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m |
| Oct. 16 | 17 49 | 17 42 | 17 36 | 17 28 | 17 24 | 17 19 | 17 13 | 17 07 | 17 03 | 17 00 | 16 56 | 16 52 | 16 48 |
| 20 | 17 48 | 17 41 | 17 33 | 17 24 | 17 19 | 17 13 | 17 06 | 16 59 | 16 55 | 16 51 | 16 47 | 16 42 | 16 36 |
| 24 | 17 48 | 17 39 | 17 30 | 17 20 | 17 14 | 17 08 | 17 00 | 16 51 | 16 47 | 16 42 | 16 37 | 16 31 | 16 25 |
| 28 | 17 47 | 17 38 | 17 28 | 17 16 | 17 10 | 17 02 | 16 54 | 16 44 | 16 39 | 16 34 | 16 28 | 16 21 | 16 14 |
| Nov. 1 | 17 47 | 17 36 | 17 25 | 17 13 | 17 06 | 16 57 | 16 48 | 16 37 | 16 31 | 16 25 | 16 19 | 16 12 | 16 04 |
| 5 | 17 47 | 17 36 | 17 24 | 17 10 | 17 02 | 16 53 | 16 43 | 16 30 | 16 24 | 16 18 | 16 11 | 16 03 | 15 53 |
| 9 | 17 47 | 17 35 | 17 22 | 17 07 | 16 59 | 16 49 | 16 38 | 16 24 | 16 18 | 16 10 | 16 03 | 15 54 | 15 44 |
| 13 | 17 48 | 17 35 | 17 21 | 17 05 | 16 56 | 16 45 | 16 33 | 16 18 | 16 11 | 16 04 | 15 55 | 15 46 | 15 35 |
| 17 | 17 49 | 17 35 | 17 20 | 17 03 | 16 53 | 16 42 | 16 29 | 16 13 | 16 06 | 15 58 | 15 49 | 15 38 | 15 26 |
| 21 | 17 50 | 17 35 | 17 19 | 17 01 | 16 51 | 16 39 | 16 26 | 16 09 | 16 01 | 15 52 | 15 42 | 15 31 | 15 18 |
| 25 | 17 51 | 17 35 | 17 19 | 17 00 | 16 50 | 16 37 | 16 23 | 16 05 | 15 57 | 15 48 | 15 37 | 15 25 | 15 11 |
| 29 | 17 52 | 17 36 | 17 19 | 17 00 | 16 49 | 16 36 | 16 21 | 16 02 | 15 53 | 15 44 | 15 33 | 15 20 | 15 05 |
| Dec. 3 | 17 54 | 17 37 | 17 20 | 17 00 | 16 48 | 16 35 | 16 19 | 16 00 | 15 51 | 15 41 | 15 29 | 15 16 | 15 00 |
| 7 | 17 55 | 17 38 | 17 21 | 17 00 | 16 48 | 16 35 | 16 18 | 15 59 | 15 49 | 15 39 | 15 27 | 15 13 | 14 56 |
| 11 | 17 57 | 17 40 | 17 22 | 17 01 | 16 49 | 16 35 | 16 18 | 15 58 | 15 48 | 15 38 | 15 25 | 15 11 | 14 54 |
| 15 | 17 59 | 17 42 | 17 23 | 17 02 | 16 50 | 16 36 | 16 19 | 15 58 | 15 49 | 15 38 | 15 25 | 15 10 | 14 53 |
| 19 | 18 01 | 17 43 | 17 25 | 17 04 | 16 51 | 16 37 | 16 20 | 15 59 | 15 50 | 15 38 | 15 26 | 15 11 | 14 54 |
| 23 | 18 03 | 17 45 | 17 27 | 17 06 | 16 53 | 16 39 | 16 22 | 16 01 | 15 52 | 15 40 | 15 28 | 15 13 | 14 55 |
| 27 | 18 05 | 17 48 | 17 29 | 17 08 | 16 56 | 16 42 | 16 25 | 16 04 | 15 54 | 15 43 | 15 31 | 15 16 | 14 59 |
| 31 | 18 07 | 17 50 | 17 31 | 17 11 | 16 58 | 16 45 | 16 28 | 16 08 | 15 58 | 15 47 | 15 35 | 15 21 | 15 04 |
| 35 | 18 09 | 17 52 | 17 34 | 17 14 | 17 02 | 16 48 | 16 32 | 16 12 | 16 03 | 15 52 | 15 40 | 15 26 | 15 10 |
| 39 | 18 10 | 17 54 | 17 37 | 17 17 | 17 05 | 16 52 | 16 36 | 16 17 | 16 08 | 15 58 | 15 46 | 15 33 | 15 17 |

END OF EVENING TWILIGHT

| Date | 0º | 10º | 20º | 30º | 35º | 40º | 45º | 50º | 52º | 54º | 56º | 58º | 60º |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m |
| Oct. 16 | 18 58 | 18 53 | 18 49 | 18 48 | 18 48 | 18 49 | 18 51 | 18 54 | 18 56 | 18 58 | 19 00 | 19 03 | 19 06 |
| 24 | 18 58 | 18 50 | 18 44 | 18 40 | 18 39 | 18 38 | 18 38 | 18 39 | 18 40 | 18 41 | 18 42 | 18 43 | 18 45 |
| Nov. 1 | 18 58 | 18 48 | 18 40 | 18 34 | 18 31 | 18 29 | 18 27 | 18 26 | 18 26 | 18 26 | 18 26 | 18 26 | 18 26 |
| 9 | 18 59 | 18 47 | 18 38 | 18 29 | 18 25 | 18 22 | 18 18 | 18 15 | 18 14 | 18 13 | 18 12 | 18 11 | 18 10 |
| 17 | 19 01 | 18 48 | 18 36 | 18 26 | 18 21 | 18 16 | 18 11 | 18 07 | 18 05 | 18 03 | 18 01 | 17 59 | 17 57 |
| 25 | 19 04 | 18 49 | 18 36 | 18 24 | 18 18 | 18 13 | 18 07 | 18 01 | 17 58 | 17 56 | 17 53 | 17 50 | 17 47 |
| Dec. 3 | 19 08 | 18 52 | 18 38 | 18 24 | 18 18 | 18 11 | 18 05 | 17 58 | 17 55 | 17 51 | 17 48 | 17 45 | 17 41 |
| 11 | 19 12 | 18 55 | 18 40 | 18 26 | 18 19 | 18 12 | 18 05 | 17 57 | 17 54 | 17 50 | 17 46 | 17 43 | 17 38 |
| 19 | 19 16 | 18 59 | 18 44 | 18 29 | 18 22 | 18 15 | 18 07 | 17 59 | 17 56 | 17 52 | 17 48 | 17 44 | 17 40 |
| 27 | 19 20 | 19 03 | 18 48 | 18 33 | 18 26 | 18 19 | 18 12 | 18 04 | 18 00 | 17 57 | 17 53 | 17 49 | 17 45 |
| 35 | 19 23 | 19 07 | 18 52 | 18 39 | 18 32 | 18 25 | 18 18 | 18 10 | 18 07 | 18 04 | 18 00 | 17 57 | 17 53 |
| 43 | 19 26 | 19 11 | 18 57 | 18 44 | 18 38 | 18 32 | 18 26 | 18 19 | 18 16 | 18 13 | 18 10 | 18 07 | 18 04 |

**DURATION OF TWILIGHT, 2021**
MORNING AND EVENING TWILIGHT: CIVIL (6º ), NAUTICAL (12º )
AND ASTRONOMICAL (18º )

| Date | Lat. | 0º Civ. | 0º Nt. | 0º Ast. | 10º Civ. | 10º Nt. | 10º Ast. | 20º Civ. | 20º Nt. | 20º Ast. | 30º Civ. | 30º Nt. | 30º Ast. | 40º Civ. | 40º Nt. | 40º Ast. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | m | m | m | m | m | m | m | m | m | m | m | m | m | m | m |
| Jan. | 0 | 23 | 49 | 75 | 23 | 49 | 75 | 24 | 51 | 79 | 26 | 56 | 85 | 30 | 64 | 97 |
| | 8 | 22 | 48 | 74 | 23 | 49 | 75 | 24 | 51 | 78 | 26 | 56 | 85 | 30 | 64 | 96 |
| | 16 | 22 | 48 | 74 | 22 | 48 | 74 | 24 | 51 | 77 | 26 | 55 | 84 | 30 | 63 | 95 |
| | 24 | 22 | 47 | 73 | 22 | 48 | 73 | 23 | 50 | 76 | 25 | 54 | 83 | 29 | 62 | 94 |
| Feb. | 1 | 22 | 47 | 72 | 22 | 47 | 73 | 23 | 49 | 76 | 25 | 54 | 82 | 29 | 61 | 93 |
| | 9 | 21 | 46 | 71 | 22 | 47 | 72 | 23 | 49 | 75 | 25 | 53 | 81 | 28 | 60 | 92 |
| | 17 | 21 | 46 | 70 | 21 | 46 | 71 | 22 | 48 | 74 | 24 | 52 | 80 | 28 | 59 | 91 |
| | 25 | 21 | 45 | 70 | 21 | 46 | 70 | 22 | 48 | 74 | 24 | 52 | 80 | 27 | 59 | 90 |
| Mar. | 5 | 21 | 45 | 69 | 21 | 46 | 70 | 22 | 48 | 73 | 24 | 52 | 79 | 27 | 59 | 90 |
| | 13 | 21 | 45 | 69 | 21 | 45 | 70 | 22 | 48 | 73 | 24 | 52 | 80 | 27 | 58 | 90 |
| | 21 | 21 | 45 | 69 | 21 | 45 | 70 | 22 | 48 | 73 | 24 | 52 | 80 | 27 | 59 | 91 |
| | 29 | 21 | 45 | 69 | 21 | 46 | 70 | 22 | 48 | 74 | 24 | 52 | 81 | 27 | 59 | 92 |
| Apr. | 6 | 21 | 45 | 69 | 21 | 46 | 71 | 22 | 48 | 75 | 24 | 53 | 82 | 28 | 61 | 95 |
| | 14 | 21 | 45 | 70 | 21 | 46 | 71 | 23 | 49 | 76 | 25 | 54 | 83 | 28 | 62 | 97 |
| | 22 | 21 | 46 | 70 | 22 | 47 | 72 | 23 | 50 | 77 | 25 | 55 | 85 | 29 | 63 | 100 |
| | 30 | 21 | 46 | 71 | 22 | 47 | 73 | 23 | 50 | 77 | 25 | 55 | 87 | 29 | 65 | 103 |
| May | 8 | 22 | 47 | 72 | 22 | 48 | 74 | 23 | 51 | 79 | 26 | 57 | 89 | 30 | 67 | 108 |
| | 16 | 22 | 47 | 73 | 22 | 49 | 75 | 24 | 52 | 81 | 26 | 58 | 91 | 31 | 69 | 112 |
| | 24 | 22 | 48 | 74 | 23 | 49 | 76 | 24 | 53 | 82 | 27 | 59 | 93 | 32 | 71 | 116 |
| June | 1 | 22 | 48 | 74 | 23 | 50 | 77 | 24 | 53 | 83 | 27 | 60 | 95 | 32 | 73 | 119 |
| | 9 | 23 | 49 | 75 | 23 | 50 | 77 | 25 | 54 | 84 | 27 | 61 | 96 | 33 | 74 | 122 |
| | 17 | 23 | 49 | 75 | 23 | 50 | 78 | 25 | 54 | 84 | 28 | 61 | 97 | 33 | 75 | 123 |
| | 25 | 23 | 49 | 75 | 23 | 50 | 78 | 25 | 54 | 84 | 27 | 61 | 97 | 33 | 75 | 123 |
| July | 3 | 23 | 49 | 75 | 23 | 50 | 77 | 24 | 54 | 84 | 27 | 60 | 96 | 33 | 74 | 122 |
| | 11 | 22 | 48 | 74 | 23 | 50 | 77 | 24 | 53 | 83 | 27 | 60 | 95 | 32 | 73 | 119 |
| | 19 | 22 | 48 | 74 | 23 | 49 | 76 | 24 | 53 | 82 | 27 | 59 | 93 | 32 | 71 | 115 |
| | 27 | 22 | 47 | 73 | 22 | 49 | 75 | 24 | 52 | 80 | 26 | 58 | 91 | 31 | 69 | 111 |
| Aug. | 4 | 22 | 47 | 72 | 22 | 48 | 74 | 23 | 51 | 79 | 26 | 56 | 88 | 30 | 67 | 106 |
| | 12 | 21 | 46 | 71 | 22 | 47 | 73 | 23 | 50 | 78 | 25 | 55 | 86 | 29 | 65 | 103 |
| | 20 | 21 | 46 | 70 | 22 | 47 | 72 | 23 | 49 | 76 | 25 | 54 | 85 | 29 | 63 | 99 |
| | 28 | 21 | 45 | 70 | 21 | 46 | 71 | 22 | 49 | 75 | 25 | 53 | 83 | 28 | 61 | 96 |
| Sept. | 5 | 21 | 45 | 69 | 21 | 46 | 71 | 22 | 48 | 74 | 24 | 53 | 82 | 28 | 60 | 94 |
| | 13 | 21 | 45 | 69 | 21 | 46 | 70 | 22 | 48 | 74 | 24 | 52 | 81 | 27 | 59 | 92 |
| | 21 | 21 | 45 | 69 | 21 | 45 | 70 | 22 | 48 | 73 | 24 | 52 | 80 | 27 | 59 | 91 |
| | 29 | 21 | 45 | 69 | 21 | 45 | 70 | 22 | 48 | 73 | 24 | 52 | 79 | 27 | 58 | 90 |
| Oct. | 7 | 21 | 45 | 69 | 21 | 46 | 70 | 22 | 48 | 73 | 24 | 52 | 79 | 27 | 58 | 90 |
| | 15 | 21 | 45 | 70 | 21 | 46 | 70 | 22 | 48 | 74 | 24 | 52 | 80 | 27 | 59 | 90 |
| | 23 | 21 | 46 | 70 | 21 | 46 | 71 | 22 | 48 | 74 | 24 | 52 | 80 | 28 | 59 | 91 |
| | 31 | 21 | 46 | 71 | 22 | 47 | 72 | 23 | 49 | 75 | 25 | 53 | 81 | 28 | 60 | 92 |
| Nov. | 8 | 22 | 47 | 72 | 22 | 47 | 73 | 23 | 49 | 76 | 25 | 54 | 82 | 29 | 61 | 93 |
| | 16 | 22 | 47 | 73 | 22 | 48 | 73 | 23 | 50 | 76 | 25 | 54 | 83 | 29 | 62 | 94 |
| | 24 | 22 | 48 | 74 | 22 | 48 | 74 | 24 | 51 | 77 | 26 | 55 | 84 | 30 | 63 | 95 |
| Dec. | 2 | 22 | 48 | 74 | 23 | 49 | 75 | 24 | 51 | 78 | 26 | 56 | 85 | 30 | 64 | 96 |
| | 10 | 23 | 49 | 75 | 23 | 49 | 75 | 24 | 51 | 78 | 26 | 56 | 85 | 30 | 64 | 97 |
| | 18 | 23 | 49 | 75 | 23 | 49 | 75 | 24 | 52 | 79 | 26 | 56 | 86 | 31 | 65 | 98 |
| | 26 | 23 | 49 | 75 | 23 | 49 | 75 | 24 | 52 | 79 | 26 | 56 | 85 | 31 | 65 | 98 |
| | 34 | 23 | 49 | 75 | 23 | 49 | 75 | 24 | 51 | 78 | 26 | 56 | 85 | 30 | 64 | 97 |

**DURATION OF TWILIGHT, 2021**
MORNING AND EVENING TWILIGHT: CIVIL (6º ), NAUTICAL (12º )
AND ASTRONOMICAL (18º )

| Date \ Lat. | | 45º Civ. | 45º Nt. | 45º Ast. | 50º Civ. | 50º Nt. | 50º Ast. | 55º Civ. | 55º Nt. | 55º Ast. | 60º Civ. | 60º Nt. | 60º Ast. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | m | m | m | m | m | m | m | m | m | m | m | m |
| Jan. | 0 | 34 | 71 | 106 | 38 | 80 | 119 | 45 | 93 | 137 | 57 | 113 | 165 |
| | 8 | 33 | 70 | 105 | 38 | 78 | 117 | 44 | 91 | 135 | 55 | 111 | 161 |
| | 16 | 33 | 69 | 104 | 37 | 77 | 116 | 43 | 88 | 132 | 52 | 106 | 156 |
| | 24 | 32 | 68 | 102 | 36 | 75 | 113 | 41 | 86 | 129 | 50 | 102 | 151 |
| Feb. | 1 | 31 | 67 | 101 | 35 | 74 | 112 | 40 | 84 | 126 | 48 | 98 | 147 |
| | 9 | 31 | 65 | 100 | 34 | 72 | 110 | 39 | 82 | 124 | 45 | 95 | 143 |
| | 17 | 30 | 64 | 98 | 33 | 71 | 108 | 38 | 80 | 122 | 44 | 92 | 140 |
| | 25 | 30 | 64 | 98 | 33 | 70 | 108 | 37 | 79 | 121 | 42 | 91 | 139 |
| Mar. | 5 | 29 | 63 | 98 | 32 | 70 | 108 | 36 | 78 | 121 | 42 | 90 | 140 |
| | 13 | 29 | 64 | 98 | 32 | 70 | 108 | 36 | 79 | 121 | 42 | 90 | 142 |
| | 21 | 29 | 64 | 99 | 32 | 71 | 110 | 36 | 80 | 125 | 42 | 92 | 147 |
| | 29 | 30 | 65 | 101 | 33 | 72 | 113 | 37 | 81 | 130 | 43 | 95 | 155 |
| Apr. | 6 | 30 | 66 | 104 | 33 | 74 | 117 | 38 | 85 | 137 | 44 | 100 | 169 |
| | 14 | 31 | 68 | 108 | 34 | 77 | 123 | 39 | 89 | 147 | 46 | 107 | 193 |
| | 22 | 32 | 70 | 112 | 35 | 80 | 130 | 41 | 94 | 161 | 50 | 119 | ** |
| | 30 | 32 | 72 | 117 | 36 | 83 | 139 | 43 | 100 | 184 | 53 | 135 | ** |
| May | 8 | 33 | 76 | 123 | 38 | 88 | 151 | 46 | 110 | ** | 59 | 169 | ** |
| | 16 | 35 | 79 | 130 | 40 | 93 | 167 | 49 | 121 | ** | 65 | ** | ** |
| | 24 | 36 | 82 | 137 | 42 | 99 | 188 | 52 | 136 | ** | 74 | ** | ** |
| June | 1 | 36 | 84 | 144 | 43 | 104 | ** | 54 | 156 | ** | 85 | ** | ** |
| | 9 | 37 | 86 | 150 | 44 | 108 | ** | 57 | 194 | ** | 96 | ** | ** |
| | 17 | 37 | 87 | 153 | 45 | 110 | ** | 58 | ** | ** | 106 | ** | ** |
| | 25 | 37 | 87 | 153 | 45 | 110 | ** | 58 | ** | ** | 105 | ** | ** |
| July | 3 | 37 | 86 | 150 | 44 | 107 | ** | 57 | 187 | ** | 95 | ** | ** |
| | 11 | 36 | 84 | 144 | 43 | 103 | ** | 54 | 154 | ** | 83 | ** | ** |
| | 19 | 35 | 81 | 137 | 41 | 98 | 186 | 51 | 134 | ** | 73 | ** | ** |
| | 27 | 34 | 78 | 129 | 40 | 93 | 165 | 48 | 120 | ** | 64 | ** | ** |
| Aug. | 4 | 33 | 75 | 123 | 38 | 87 | 149 | 45 | 109 | ** | 58 | 165 | ** |
| | 12 | 32 | 72 | 116 | 36 | 82 | 138 | 42 | 100 | 182 | 53 | 134 | ** |
| | 20 | 31 | 69 | 111 | 35 | 79 | 129 | 41 | 93 | 160 | 49 | 118 | ** |
| | 28 | 31 | 67 | 107 | 34 | 76 | 122 | 39 | 88 | 146 | 46 | 107 | 192 |
| Sept. | 5 | 30 | 66 | 104 | 33 | 74 | 117 | 38 | 84 | 136 | 44 | 100 | 168 |
| | 13 | 30 | 65 | 101 | 33 | 72 | 113 | 37 | 81 | 130 | 43 | 95 | 155 |
| | 21 | 29 | 64 | 99 | 32 | 71 | 110 | 36 | 79 | 125 | 42 | 92 | 147 |
| | 29 | 29 | 63 | 98 | 32 | 70 | 108 | 36 | 78 | 122 | 41 | 90 | 142 |
| Oct. | 7 | 29 | 63 | 97 | 32 | 70 | 107 | 36 | 78 | 121 | 42 | 90 | 139 |
| | 15 | 30 | 64 | 98 | 33 | 70 | 107 | 37 | 78 | 121 | 42 | 90 | 139 |
| | 23 | 30 | 64 | 98 | 33 | 71 | 108 | 37 | 80 | 121 | 43 | 92 | 140 |
| | 31 | 31 | 65 | 99 | 34 | 72 | 109 | 38 | 81 | 123 | 45 | 94 | 142 |
| Nov. | 8 | 31 | 66 | 101 | 35 | 74 | 111 | 40 | 84 | 126 | 47 | 98 | 146 |
| | 16 | 32 | 68 | 102 | 36 | 75 | 113 | 41 | 86 | 129 | 50 | 102 | 151 |
| | 24 | 33 | 69 | 104 | 37 | 77 | 116 | 43 | 88 | 132 | 52 | 106 | 156 |
| Dec. | 2 | 33 | 70 | 105 | 38 | 78 | 117 | 44 | 91 | 135 | 55 | 110 | 161 |
| | 10 | 34 | 71 | 106 | 38 | 80 | 119 | 45 | 92 | 137 | 57 | 113 | 164 |
| | 18 | 34 | 71 | 107 | 39 | 80 | 120 | 46 | 93 | 138 | 58 | 115 | 166 |
| | 26 | 34 | 71 | 107 | 38 | 80 | 119 | 46 | 93 | 138 | 58 | 114 | 166 |
| | 34 | 34 | 71 | 106 | 38 | 79 | 119 | 45 | 92 | 136 | 56 | 112 | 163 |

**SUNRISE, SUNSET AND TWILIGHT, 2021**
**CORRECTION FOR SOUTHERN LATITUDES**

| For | Use | Add | For | Use | Add | For | Use | Add | For | Use | Add | For | Use | Add |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| July | Dec. | m | Aug. | Feb. | m | Sept. | Mar. | m | Oct. | Apr. | m | Nov. | May | m |
| 1 | 31 | +1 | 7 | 3 | -8 | 12 | 10 | -14 | 19 | 16 | -15 | 26 | 25 | -10 |
| July | Jan. | | 8 | 4 | 8 | 13 | 11 | 14 | 20 | 17 | 15 | 27 | 26 | 9 |
| 2 | 0 | +1 | 9 | 5 | 9 | 14 | 12 | 14 | 21 | 18 | 15 | 28 | 27 | 9 |
| 3 | 1 | 0 | 10 | 6 | 9 | 15 | 13 | 14 | 22 | 19 | 15 | 29 | 28 | 9 |
| 4 | 2 | 0 | 11 | 7 | 9 | 16 | 14 | 14 | 23 | 20 | 15 | 30 | 29 | 9 |
| 5 | 3 | 0 | 12 | 8 | 9 | 17 | 15 | 15 | 24 | 21 | 14 | Dec. | May | |
| 6 | 4 | -1 | 13 | 9 | 9 | 18 | 16 | 15 | 25 | 22 | 14 | 1 | 30 | 8 |
| 7 | 5 | 1 | 14 | 10 | 10 | 19 | 17 | 15 | 26 | 23 | 14 | 2 | 31 | 8 |
| 8 | 6 | 1 | 15 | 11 | 10 | 20 | 18 | 15 | 27 | 24 | 14 | Dec. | June | |
| 9 | 7 | 1 | 16 | 12 | 10 | 21 | 19 | 15 | 28 | 25 | 14 | 3 | 1 | 8 |
| 10 | 8 | 2 | 17 | 13 | 10 | 22 | 20 | 15 | 29 | 26 | 14 | 4 | 2 | 8 |
| 11 | 9 | 2 | 18 | 14 | 10 | 23 | 21 | 15 | 30 | 27 | 14 | 5 | 3 | 7 |
| 12 | 10 | 2 | 19 | 15 | 11 | 24 | 22 | 15 | 31 | 28 | 14 | 6 | 5 | 7 |
| 13 | 11 | 2 | 20 | 16 | 11 | 25 | 23 | 15 | Nov. | Apr. | | 7 | 6 | 7 |
| 14 | 12 | 3 | 21 | 17 | 11 | 26 | 24 | 15 | 1 | 29 | 14 | 8 | 7 | 7 |
| 15 | 13 | 3 | 22 | 18 | 11 | 27 | 25 | 15 | 2 | 30 | 14 | 9 | 8 | 6 |
| 16 | 14 | 3 | 23 | 19 | 11 | 28 | 26 | 15 | Nov. | May | | 10 | 9 | 6 |
| 17 | 15 | 3 | 24 | 19 | 12 | 29 | 26 | 15 | 3 | 1 | 13 | 11 | 10 | 6 |
| 18 | 16 | 3 | 25 | 20 | 12 | 30 | 27 | 15 | 4 | 2 | 13 | 12 | 11 | 6 |
| 19 | 16 | 4 | 26 | 21 | 12 | Oct. | Mar. | | 5 | 3 | 13 | 13 | 12 | 5 |
| 20 | 17 | 4 | 27 | 22 | 12 | 1 | 28 | 15 | 6 | 4 | 13 | 14 | 13 | 5 |
| 21 | 18 | 4 | 28 | 23 | 12 | 2 | 29 | 15 | 7 | 5 | 13 | 15 | 14 | 5 |
| 22 | 19 | 4 | 29 | 24 | 12 | 3 | 30 | 15 | 8 | 6 | 13 | 16 | 15 | 5 |
| 23 | 20 | 5 | 30 | 25 | 13 | 4 | 31 | 15 | 9 | 7 | 13 | 17 | 16 | 4 |
| 24 | 21 | 5 | 31 | 26 | 13 | Oct. | Apr. | | 10 | 8 | 12 | 18 | 17 | 4 |
| 25 | 22 | 5 | Sept. | Feb. | | 5 | 1 | 16 | 11 | 9 | 12 | 19 | 18 | 4 |
| 26 | 23 | 6 | 1 | 27 | 13 | 6 | 2 | 16 | 12 | 10 | 12 | 20 | 19 | 4 |
| 27 | 24 | 6 | 2 | 28 | 13 | 7 | 3 | 16 | 13 | 11 | 12 | 21 | 21 | 3 |
| 28 | 25 | 6 | | | | 8 | 4 | 15 | 14 | 12 | 12 | 22 | 22 | 3 |
| 29 | 26 | 6 | Sept. | Mar. | | 9 | 5 | 15 | 15 | 13 | 12 | 23 | 23 | 3 |
| 30 | 27 | 7 | 3 | 1 | 13 | 10 | 6 | 15 | 16 | 14 | 12 | 24 | 24 | 3 |
| 31 | 28 | 7 | 4 | 2 | 13 | 11 | 7 | 15 | 17 | 15 | 11 | 25 | 25 | 2 |
| Aug. | Jan. | | 5 | 3 | 13 | 12 | 9 | 15 | 18 | 17 | 11 | 26 | 26 | 2 |
| 1 | 29 | 7 | 6 | 4 | 14 | 13 | 10 | 15 | 19 | 18 | 11 | 27 | 27 | 2 |
| 2 | 30 | 7 | 7 | 5 | 14 | 14 | 11 | 15 | 20 | 19 | 11 | 28 | 28 | 2 |
| 3 | 30 | 7 | 8 | 6 | 14 | 15 | 12 | 15 | 21 | 20 | 11 | 29 | 29 | 1 |
| 4 | 31 | 8 | 9 | 7 | 14 | 16 | 13 | 15 | 22 | 21 | 10 | 30 | 30 | 1 |
| Aug. | Feb. | | 10 | 8 | 14 | 17 | 14 | 15 | 23 | 22 | 10 | Dec. | July | |
| 5 | 1 | 8 | 11 | 9 | 14 | 18 | 15 | 15 | 24 | 23 | 10 | 31 | 1 | -1 |
| 6 | 2 | -8 | 12 | 10 | -14 | 19 | 16 | -15 | 25 | 24 | -10 | 32 | 2 | 0 |

To obtain the times of sunrise, sunset and twilight for southern latitudes for any date, use the tables for the same northern latitude for the corresponding date given above, and apply to the times so obtained the correction given in the column headed 'Add'.

In the case of duration of twilight, however, take only the figures for the corresponding date without correction.

## SUNRISE, SUNSET AND TWILIGHT, 2021
## CORRECTION FOR SOUTHERN LATITUDES

| For | Use | Add | For | Use | Add | For | Use | Add | For | Use | Add | For | Use | Add |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan. | July | m | Feb. | Aug. | m | Mar. | Sept. | m | Apr. | Oct. | m | May | Nov. | m |
| 0 | 1 | 0 | 5 | 9 | +9 | 13 | 15 | +14 | 19 | 22 | +15 | 25 | 26 | +10 |
| 1 | 3 | 0 | 6 | 10 | 9 | 14 | 16 | 14 | 20 | 23 | 15 | 26 | 27 | 9 |
| 2 | 4 | 0 | 7 | 11 | 9 | 15 | 17 | 14 | 21 | 24 | 14 | 27 | 28 | 9 |
| | | | 8 | 12 | 9 | 16 | 18 | 15 | 22 | 25 | 14 | 28 | 29 | 9 |
| 3 | 5 | 0 | 9 | 13 | 9 | 17 | 19 | 15 | 23 | 26 | 14 | 29 | 30 | 9 |
| 4 | 6 | +1 | 10 | 14 | 10 | 18 | 20 | 15 | 24 | 27 | 14 | May | Dec. | |
| 5 | 7 | 1 | 11 | 15 | 10 | 19 | 21 | 15 | 25 | 28 | 14 | 30 | 1 | 8 |
| 6 | 8 | 1 | 12 | 16 | 10 | 20 | 22 | 15 | 26 | 29 | 14 | 31 | 2 | 8 |
| 7 | 9 | 1 | 13 | 17 | 10 | 21 | 23 | 15 | 27 | 30 | 14 | June | Dec. | |
| 8 | 10 | 2 | 14 | 18 | 10 | 22 | 24 | 15 | 28 | 31 | 14 | 1 | 3 | 8 |
| 9 | 11 | 2 | 15 | 19 | 11 | 23 | 25 | 15 | Apr. | Nov. | | 2 | 4 | 8 |
| 10 | 12 | 2 | 16 | 20 | 11 | 24 | 26 | 15 | 29 | 1 | 14 | 3 | 5 | 7 |
| 11 | 13 | 2 | 17 | 21 | 11 | 25 | 27 | 15 | 30 | 2 | 14 | 4 | 5 | 7 |
| 12 | 14 | 3 | 18 | 22 | 11 | 26 | 29 | 15 | May | Nov. | | 5 | 6 | 7 |
| 13 | 15 | 3 | 19 | 23 | 11 | 27 | 30 | 15 | 1 | 3 | 13 | 6 | 7 | 7 |
| 14 | 16 | 3 | 20 | 25 | 12 | Mar. | Oct. | | 2 | 4 | 13 | 7 | 8 | 7 |
| 15 | 17 | 3 | 21 | 26 | 12 | 28 | 1 | 15 | 3 | 5 | 13 | 8 | 9 | 6 |
| 16 | 18 | 4 | 22 | 27 | 12 | 29 | 2 | 15 | 4 | 6 | 13 | 9 | 10 | 6 |
| 17 | 19 | 4 | 23 | 28 | 12 | 30 | 3 | 15 | 5 | 7 | 13 | 10 | 11 | 6 |
| 18 | 21 | 4 | 24 | 29 | 12 | 31 | 4 | 16 | 6 | 8 | 13 | 11 | 12 | 6 |
| 19 | 22 | 5 | 25 | 30 | 13 | Apr. | Oct. | | 7 | 9 | 13 | 12 | 13 | 5 |
| 20 | 23 | 5 | 26 | 31 | 13 | 1 | 5 | 16 | 8 | 10 | 12 | 13 | 14 | 5 |
| 21 | 24 | 5 | | | | 2 | 6 | 16 | 9 | 11 | 12 | 14 | 15 | 5 |
| 22 | 25 | 5 | Feb. | Sept. | | 3 | 7 | 16 | 10 | 12 | 12 | 15 | 16 | 5 |
| 23 | 26 | 6 | 27 | 1 | 13 | 4 | 7 | 15 | 11 | 13 | 12 | 16 | 17 | 4 |
| 24 | 27 | 6 | 28 | 2 | 13 | 5 | 8 | 15 | 12 | 14 | 12 | 17 | 18 | 4 |
| 25 | 28 | 6 | Mar. | Sept. | | 6 | 9 | 15 | 13 | 15 | 12 | 18 | 19 | 4 |
| 26 | 29 | 6 | 1 | 3 | 13 | 7 | 10 | 15 | 14 | 16 | 12 | 19 | 20 | 4 |
| 27 | 30 | 7 | 2 | 4 | 13 | 8 | 11 | 15 | 15 | 16 | 11 | 20 | 21 | 3 |
| 28 | 31 | 7 | 3 | 5 | 13 | 9 | 12 | 15 | 16 | 17 | 11 | 21 | 21 | 3 |
| Jan. | Aug. | | 4 | 6 | 14 | 10 | 13 | 15 | 17 | 18 | 11 | 22 | 22 | 3 |
| 29 | 1 | 7 | 5 | 7 | 14 | 11 | 14 | 15 | 18 | 19 | 11 | 23 | 23 | 3 |
| 30 | 2 | 7 | 6 | 8 | 14 | 12 | 15 | 15 | 19 | 20 | 11 | 24 | 24 | 3 |
| 31 | 3 | 7 | 7 | 9 | 14 | 13 | 16 | 15 | 20 | 21 | 11 | 25 | 25 | 2 |
| Feb. | Aug. | | 8 | 10 | 14 | 14 | 17 | 15 | 21 | 22 | 10 | 26 | 26 | 2 |
| 1 | 5 | 8 | 9 | 11 | 14 | 15 | 18 | 15 | 22 | 23 | 10 | 27 | 27 | 2 |
| 2 | 6 | 8 | 10 | 12 | 14 | 16 | 19 | 15 | 23 | 24 | 10 | 28 | 28 | 1 |
| 3 | 7 | 8 | 11 | 13 | 14 | 17 | 20 | 15 | 24 | 25 | 10 | 29 | 29 | 1 |
| 4 | 8 | +9 | 12 | 14 | +14 | 18 | 21 | +15 | 25 | 26 | +10 | 30 | 30 | +1 |

To obtain the times of sunrise, sunset and twilight for southern latitudes for any date, use the tables for the same northern latitude for the corresponding date given above, and apply to the times so obtained the correction given in the column headed 'Add'.

In the case of duration of twilight, however, take only the figures for the corresponding date without correction.

## SUNRISE AND SUNSET, 2021

INDIAN STANDARD TIME OF SUNRISE AND SUNSET (SUN'S UPPER LIMB)
FOR CERTAIN STATIONS IN INDIA

| Date | Kolkata 22º N 32' | | | | Varanasi 25º N 18' | | | | Chennai 13º N 00' | | | | Delhi 28º N 35' | | | | Mumbai 18º N 54' | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rise | | Set | | Rise | | Set | | Rise | | Set | | Rise | | Set | | Rise | | Set | |
| | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m |
| Jan. 1 | 6 | 17 | 17 | 04 | 6 | 44 | 17 | 19 | 6 | 31 | 17 | 54 | 7 | 14 | 17 | 36 | 7 | 12 | 18 | 12 |
| 3 | 6 | 17 | 17 | 05 | 6 | 44 | 17 | 21 | 6 | 32 | 17 | 55 | 7 | 15 | 17 | 37 | 7 | 13 | 18 | 14 |
| 5 | 6 | 18 | 17 | 06 | 6 | 45 | 17 | 22 | 6 | 33 | 17 | 56 | 7 | 15 | 17 | 38 | 7 | 13 | 18 | 15 |
| 7 | 6 | 18 | 17 | 08 | 6 | 45 | 17 | 24 | 6 | 33 | 17 | 57 | 7 | 16 | 17 | 40 | 7 | 14 | 18 | 16 |
| 9 | 6 | 19 | 17 | 09 | 6 | 45 | 17 | 25 | 6 | 34 | 17 | 58 | 7 | 16 | 17 | 42 | 7 | 14 | 18 | 17 |
| 11 | 6 | 19 | 17 | 11 | 6 | 46 | 17 | 27 | 6 | 35 | 17 | 59 | 7 | 16 | 17 | 43 | 7 | 15 | 18 | 19 |
| 13 | 6 | 19 | 17 | 12 | 6 | 46 | 17 | 28 | 6 | 35 | 18 | 00 | 7 | 16 | 17 | 45 | 7 | 15 | 18 | 20 |
| 15 | 6 | 19 | 17 | 13 | 6 | 46 | 17 | 30 | 6 | 35 | 18 | 02 | 7 | 16 | 17 | 46 | 7 | 15 | 18 | 21 |
| 17 | 6 | 19 | 17 | 15 | 6 | 45 | 17 | 31 | 6 | 36 | 18 | 03 | 7 | 15 | 17 | 48 | 7 | 15 | 18 | 22 |
| 19 | 6 | 19 | 17 | 16 | 6 | 45 | 17 | 33 | 6 | 36 | 18 | 04 | 7 | 15 | 17 | 50 | 7 | 15 | 18 | 24 |
| 21 | 6 | 19 | 17 | 18 | 6 | 45 | 17 | 34 | 6 | 36 | 18 | 05 | 7 | 14 | 17 | 51 | 7 | 15 | 18 | 25 |
| 23 | 6 | 18 | 17 | 19 | 6 | 44 | 17 | 36 | 6 | 36 | 18 | 06 | 7 | 14 | 17 | 53 | 7 | 15 | 18 | 26 |
| 25 | 6 | 18 | 17 | 20 | 6 | 44 | 17 | 37 | 6 | 36 | 18 | 07 | 7 | 13 | 17 | 55 | 7 | 15 | 18 | 27 |
| 27 | 6 | 17 | 17 | 22 | 6 | 43 | 17 | 39 | 6 | 36 | 18 | 08 | 7 | 12 | 17 | 56 | 7 | 14 | 18 | 29 |
| 29 | 6 | 17 | 17 | 23 | 6 | 42 | 17 | 40 | 6 | 36 | 18 | 08 | 7 | 11 | 17 | 58 | 7 | 14 | 18 | 30 |
| 31 | 6 | 16 | 17 | 24 | 6 | 42 | 17 | 42 | 6 | 36 | 18 | 09 | 7 | 10 | 17 | 59 | 7 | 13 | 18 | 31 |
| Feb. 2 | 6 | 15 | 17 | 26 | 6 | 41 | 17 | 43 | 6 | 35 | 18 | 10 | 7 | 09 | 18 | 01 | 7 | 13 | 18 | 32 |
| 4 | 6 | 15 | 17 | 27 | 6 | 40 | 17 | 44 | 6 | 35 | 18 | 11 | 7 | 08 | 18 | 03 | 7 | 12 | 18 | 33 |
| 6 | 6 | 14 | 17 | 28 | 6 | 39 | 17 | 46 | 6 | 34 | 18 | 12 | 7 | 07 | 18 | 04 | 7 | 11 | 18 | 34 |
| 8 | 6 | 13 | 17 | 29 | 6 | 37 | 17 | 47 | 6 | 34 | 18 | 12 | 7 | 05 | 18 | 06 | 7 | 11 | 18 | 35 |
| 10 | 6 | 12 | 17 | 31 | 6 | 36 | 17 | 49 | 6 | 33 | 18 | 13 | 7 | 04 | 18 | 07 | 7 | 10 | 18 | 36 |
| 12 | 6 | 10 | 17 | 32 | 6 | 35 | 17 | 50 | 6 | 33 | 18 | 14 | 7 | 02 | 18 | 09 | 7 | 09 | 18 | 37 |
| 14 | 6 | 09 | 17 | 33 | 6 | 33 | 17 | 51 | 6 | 32 | 18 | 14 | 7 | 01 | 18 | 10 | 7 | 08 | 18 | 38 |
| 16 | 6 | 08 | 17 | 34 | 6 | 32 | 17 | 52 | 6 | 31 | 18 | 15 | 6 | 59 | 18 | 12 | 7 | 07 | 18 | 39 |
| 18 | 6 | 07 | 17 | 35 | 6 | 30 | 17 | 54 | 6 | 30 | 18 | 15 | 6 | 57 | 18 | 13 | 7 | 06 | 18 | 40 |
| 20 | 6 | 05 | 17 | 36 | 6 | 29 | 17 | 55 | 6 | 30 | 18 | 16 | 6 | 55 | 18 | 15 | 7 | 04 | 18 | 41 |
| 22 | 6 | 04 | 17 | 37 | 6 | 27 | 17 | 56 | 6 | 29 | 18 | 16 | 6 | 53 | 18 | 16 | 7 | 03 | 18 | 41 |
| 24 | 6 | 02 | 17 | 38 | 6 | 25 | 17 | 57 | 6 | 28 | 18 | 17 | 6 | 52 | 18 | 17 | 7 | 02 | 18 | 42 |
| 26 | 6 | 01 | 17 | 39 | 6 | 24 | 17 | 58 | 6 | 27 | 18 | 17 | 6 | 50 | 18 | 19 | 7 | 00 | 18 | 43 |
| 28 | 5 | 59 | 17 | 40 | 6 | 22 | 17 | 59 | 6 | 26 | 18 | 17 | 6 | 47 | 18 | 20 | 6 | 59 | 18 | 44 |
| Mar. 2 | 5 | 58 | 17 | 41 | 6 | 20 | 18 | 00 | 6 | 24 | 18 | 18 | 6 | 45 | 18 | 21 | 6 | 57 | 18 | 44 |
| 4 | 5 | 56 | 17 | 42 | 6 | 18 | 18 | 01 | 6 | 23 | 18 | 18 | 6 | 43 | 18 | 23 | 6 | 56 | 18 | 45 |
| 6 | 5 | 54 | 17 | 42 | 6 | 16 | 18 | 02 | 6 | 22 | 18 | 18 | 6 | 41 | 18 | 24 | 6 | 54 | 18 | 46 |
| 8 | 5 | 52 | 17 | 43 | 6 | 14 | 18 | 03 | 6 | 21 | 18 | 18 | 6 | 39 | 18 | 25 | 6 | 53 | 18 | 46 |
| 10 | 5 | 51 | 17 | 44 | 6 | 12 | 18 | 04 | 6 | 20 | 18 | 19 | 6 | 37 | 18 | 26 | 6 | 51 | 18 | 47 |
| 12 | 5 | 49 | 17 | 45 | 6 | 10 | 18 | 05 | 6 | 18 | 18 | 19 | 6 | 34 | 18 | 27 | 6 | 50 | 18 | 47 |
| 14 | 5 | 47 | 17 | 46 | 6 | 08 | 18 | 06 | 6 | 17 | 18 | 19 | 6 | 32 | 18 | 29 | 6 | 48 | 18 | 48 |
| 16 | 5 | 45 | 17 | 46 | 6 | 06 | 18 | 07 | 6 | 16 | 18 | 19 | 6 | 30 | 18 | 30 | 6 | 46 | 18 | 48 |
| 18 | 5 | 43 | 17 | 47 | 6 | 04 | 18 | 08 | 6 | 15 | 18 | 19 | 6 | 28 | 18 | 31 | 6 | 45 | 18 | 49 |
| 20 | 5 | 41 | 17 | 48 | 6 | 02 | 18 | 09 | 6 | 13 | 18 | 20 | 6 | 25 | 18 | 32 | 6 | 43 | 18 | 49 |
| 22 | 5 | 40 | 17 | 49 | 6 | 00 | 18 | 10 | 6 | 12 | 18 | 20 | 6 | 23 | 18 | 33 | 6 | 41 | 18 | 50 |
| 24 | 5 | 38 | 17 | 49 | 5 | 58 | 18 | 11 | 6 | 11 | 18 | 20 | 6 | 21 | 18 | 34 | 6 | 40 | 18 | 50 |
| 26 | 5 | 36 | 17 | 50 | 5 | 56 | 18 | 11 | 6 | 09 | 18 | 20 | 6 | 18 | 18 | 35 | 6 | 38 | 18 | 51 |
| 28 | 5 | 34 | 17 | 51 | 5 | 54 | 18 | 12 | 6 | 08 | 18 | 20 | 6 | 16 | 18 | 37 | 6 | 36 | 18 | 51 |
| 30 | 5 | 32 | 17 | 51 | 5 | 52 | 18 | 13 | 6 | 07 | 18 | 20 | 6 | 14 | 18 | 38 | 6 | 34 | 18 | 52 |
| Apr. 1 | 5 | 30 | 17 | 52 | 5 | 50 | 18 | 14 | 6 | 05 | 18 | 20 | 6 | 11 | 18 | 39 | 6 | 33 | 18 | 52 |
| 3 | 5 | 28 | 17 | 53 | 5 | 48 | 18 | 15 | 6 | 04 | 18 | 20 | 6 | 09 | 18 | 40 | 6 | 31 | 18 | 53 |

**SUNRISE AND SUNSET, 2021**

INDIAN STANDARD TIME OF SUNRISE AND SUNSET (SUN'S UPPER LIMB)
FOR CERTAIN STATIONS IN INDIA

| Date | | Kolkata 22º N 32' | | | | Varanasi 25º N 18' | | | | Chennai 13º N 00' | | | | Delhi 28º N 35' | | | | Mumbai 18º N 54' | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rise | | Set | | Rise | | Set | | Rise | | Set | | Rise | | Set | | Rise | | Set | |
| | | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m |
| Apr. | 5 | 5 | 26 | 17 | 53 | 5 | 46 | 18 | 16 | 6 | 03 | 18 | 21 | 6 | 07 | 18 | 41 | 6 | 30 | 18 | 53 |
| | 7 | 5 | 24 | 17 | 54 | 5 | 44 | 18 | 17 | 6 | 02 | 18 | 21 | 6 | 05 | 18 | 42 | 6 | 28 | 18 | 54 |
| | 9 | 5 | 23 | 17 | 55 | 5 | 42 | 18 | 18 | 6 | 00 | 18 | 21 | 6 | 02 | 18 | 43 | 6 | 26 | 18 | 54 |
| | 11 | 5 | 21 | 17 | 56 | 5 | 40 | 18 | 19 | 5 | 59 | 18 | 21 | 6 | 00 | 18 | 44 | 6 | 25 | 18 | 55 |
| | 13 | 5 | 19 | 17 | 56 | 5 | 38 | 18 | 19 | 5 | 58 | 18 | 21 | 5 | 58 | 18 | 46 | 6 | 23 | 18 | 55 |
| | 15 | 5 | 17 | 17 | 57 | 5 | 36 | 18 | 20 | 5 | 57 | 18 | 21 | 5 | 56 | 18 | 47 | 6 | 22 | 18 | 56 |
| | 17 | 5 | 15 | 17 | 58 | 5 | 34 | 18 | 21 | 5 | 56 | 18 | 22 | 5 | 54 | 18 | 48 | 6 | 20 | 18 | 56 |
| | 19 | 5 | 14 | 17 | 58 | 5 | 32 | 18 | 22 | 5 | 55 | 18 | 22 | 5 | 52 | 18 | 49 | 6 | 19 | 18 | 57 |
| | 21 | 5 | 12 | 17 | 59 | 5 | 31 | 18 | 23 | 5 | 53 | 18 | 22 | 5 | 50 | 18 | 50 | 6 | 17 | 18 | 58 |
| | 23 | 5 | 11 | 17 | 60 | 5 | 29 | 18 | 24 | 5 | 52 | 18 | 22 | 5 | 48 | 18 | 51 | 6 | 16 | 18 | 58 |
| | 25 | 5 | 09 | 18 | 01 | 5 | 27 | 18 | 25 | 5 | 51 | 18 | 23 | 5 | 46 | 18 | 53 | 6 | 15 | 18 | 59 |
| | 27 | 5 | 08 | 18 | 02 | 5 | 26 | 18 | 26 | 5 | 51 | 18 | 23 | 5 | 44 | 18 | 54 | 6 | 13 | 18 | 59 |
| | 29 | 5 | 06 | 18 | 02 | 5 | 24 | 18 | 27 | 5 | 50 | 18 | 23 | 5 | 43 | 18 | 55 | 6 | 12 | 19 | 00 |
| May | 1 | 5 | 05 | 18 | 03 | 5 | 22 | 18 | 28 | 5 | 49 | 18 | 24 | 5 | 41 | 18 | 56 | 6 | 11 | 19 | 01 |
| | 3 | 5 | 03 | 18 | 04 | 5 | 21 | 18 | 29 | 5 | 48 | 18 | 24 | 5 | 39 | 18 | 57 | 6 | 10 | 19 | 01 |
| | 5 | 5 | 02 | 18 | 05 | 5 | 20 | 18 | 30 | 5 | 47 | 18 | 25 | 5 | 38 | 18 | 59 | 6 | 09 | 19 | 02 |
| | 7 | 5 | 01 | 18 | 06 | 5 | 18 | 18 | 31 | 5 | 46 | 18 | 25 | 5 | 36 | 18 | 60 | 6 | 08 | 19 | 03 |
| | 9 | 4 | 60 | 18 | 07 | 5 | 17 | 18 | 32 | 5 | 46 | 18 | 25 | 5 | 35 | 19 | 01 | 6 | 07 | 19 | 04 |
| | 11 | 4 | 59 | 18 | 08 | 5 | 16 | 18 | 33 | 5 | 45 | 18 | 26 | 5 | 33 | 19 | 02 | 6 | 06 | 19 | 04 |
| | 13 | 4 | 58 | 18 | 09 | 5 | 15 | 18 | 34 | 5 | 45 | 18 | 26 | 5 | 32 | 19 | 04 | 6 | 05 | 19 | 05 |
| | 15 | 4 | 57 | 18 | 09 | 5 | 14 | 18 | 35 | 5 | 44 | 18 | 27 | 5 | 31 | 19 | 05 | 6 | 04 | 19 | 06 |
| | 17 | 4 | 56 | 18 | 10 | 5 | 13 | 18 | 36 | 5 | 44 | 18 | 27 | 5 | 30 | 19 | 06 | 6 | 04 | 19 | 07 |
| | 19 | 4 | 55 | 18 | 11 | 5 | 12 | 18 | 37 | 5 | 43 | 18 | 28 | 5 | 29 | 19 | 07 | 6 | 03 | 19 | 07 |
| | 21 | 4 | 55 | 18 | 12 | 5 | 11 | 18 | 38 | 5 | 43 | 18 | 29 | 5 | 28 | 19 | 08 | 6 | 03 | 19 | 08 |
| | 23 | 4 | 54 | 18 | 13 | 5 | 10 | 18 | 40 | 5 | 43 | 18 | 29 | 5 | 27 | 19 | 10 | 6 | 02 | 19 | 09 |
| | 25 | 4 | 53 | 18 | 14 | 5 | 10 | 18 | 41 | 5 | 42 | 18 | 30 | 5 | 26 | 19 | 11 | 6 | 02 | 19 | 10 |
| | 27 | 4 | 53 | 18 | 15 | 5 | 09 | 18 | 42 | 5 | 42 | 18 | 30 | 5 | 25 | 19 | 12 | 6 | 01 | 19 | 11 |
| | 29 | 4 | 52 | 18 | 16 | 5 | 08 | 18 | 43 | 5 | 42 | 18 | 31 | 5 | 25 | 19 | 13 | 6 | 01 | 19 | 11 |
| | 31 | 4 | 52 | 18 | 17 | 5 | 08 | 18 | 43 | 5 | 42 | 18 | 32 | 5 | 24 | 19 | 14 | 6 | 01 | 19 | 12 |
| June | 2 | 4 | 52 | 18 | 17 | 5 | 08 | 18 | 44 | 5 | 42 | 18 | 32 | 5 | 24 | 19 | 15 | 6 | 01 | 19 | 13 |
| | 4 | 4 | 52 | 18 | 18 | 5 | 08 | 18 | 45 | 5 | 42 | 18 | 33 | 5 | 24 | 19 | 16 | 6 | 01 | 19 | 14 |
| | 6 | 4 | 52 | 18 | 19 | 5 | 07 | 18 | 46 | 5 | 42 | 18 | 33 | 5 | 23 | 19 | 17 | 6 | 01 | 19 | 14 |
| | 8 | 4 | 52 | 18 | 20 | 5 | 07 | 18 | 47 | 5 | 42 | 18 | 34 | 5 | 23 | 19 | 18 | 6 | 01 | 19 | 15 |
| | 10 | 4 | 52 | 18 | 20 | 5 | 07 | 18 | 48 | 5 | 43 | 18 | 35 | 5 | 23 | 19 | 19 | 6 | 01 | 19 | 16 |
| | 12 | 4 | 52 | 18 | 21 | 5 | 07 | 18 | 48 | 5 | 43 | 18 | 35 | 5 | 23 | 19 | 19 | 6 | 01 | 19 | 16 |
| | 14 | 4 | 52 | 18 | 22 | 5 | 08 | 18 | 49 | 5 | 43 | 18 | 36 | 5 | 23 | 19 | 20 | 6 | 01 | 19 | 17 |
| | 16 | 4 | 52 | 18 | 22 | 5 | 08 | 18 | 50 | 5 | 43 | 18 | 36 | 5 | 24 | 19 | 21 | 6 | 02 | 19 | 18 |
| | 18 | 4 | 53 | 18 | 23 | 5 | 08 | 18 | 50 | 5 | 44 | 18 | 37 | 5 | 24 | 19 | 21 | 6 | 02 | 19 | 18 |
| | 20 | 4 | 53 | 18 | 23 | 5 | 08 | 18 | 51 | 5 | 44 | 18 | 37 | 5 | 24 | 19 | 22 | 6 | 02 | 19 | 19 |
| | 22 | 4 | 53 | 18 | 24 | 5 | 09 | 18 | 51 | 5 | 45 | 18 | 38 | 5 | 25 | 19 | 22 | 6 | 03 | 19 | 19 |
| | 24 | 4 | 54 | 18 | 24 | 5 | 09 | 18 | 52 | 5 | 45 | 18 | 38 | 5 | 25 | 19 | 23 | 6 | 03 | 19 | 19 |
| | 26 | 4 | 54 | 18 | 24 | 5 | 10 | 18 | 52 | 5 | 46 | 18 | 38 | 5 | 26 | 19 | 23 | 6 | 04 | 19 | 20 |
| | 28 | 4 | 55 | 18 | 25 | 5 | 11 | 18 | 52 | 5 | 46 | 18 | 39 | 5 | 26 | 19 | 23 | 6 | 04 | 19 | 20 |
| | 30 | 4 | 56 | 18 | 25 | 5 | 11 | 18 | 52 | 5 | 47 | 18 | 39 | 5 | 27 | 19 | 23 | 6 | 05 | 19 | 20 |
| July | 2 | 4 | 56 | 18 | 25 | 5 | 12 | 18 | 52 | 5 | 47 | 18 | 39 | 5 | 28 | 19 | 23 | 6 | 05 | 19 | 20 |
| | 4 | 4 | 57 | 18 | 25 | 5 | 13 | 18 | 52 | 5 | 48 | 18 | 39 | 5 | 29 | 19 | 23 | 6 | 06 | 19 | 20 |
| | 6 | 4 | 58 | 18 | 25 | 5 | 13 | 18 | 52 | 5 | 48 | 18 | 39 | 5 | 29 | 19 | 23 | 6 | 07 | 19 | 20 |

**SUNRISE AND SUNSET, 2021**

INDIAN STANDARD TIME OF SUNRISE AND SUNSET (SUN'S UPPER LIMB)
FOR CERTAIN STATIONS IN INDIA

| Date | | Kolkata 22º N 32' | | | | Varanasi 25º N 18' | | | | Chennai 13º N 00' | | | | Delhi 28º N 35' | | | | Mumbai 18º N 54' | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rise | | Set | | Rise | | Set | | Rise | | Set | | Rise | | Set | | Rise | | Set | |
| | | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m |
| July | 8 | 4 | 59 | 18 | 25 | 5 | 14 | 18 | 52 | 5 | 49 | 18 | 40 | 5 | 30 | 19 | 23 | 6 | 07 | 19 | 20 |
| | 10 | 4 | 59 | 18 | 25 | 5 | 15 | 18 | 52 | 5 | 49 | 18 | 40 | 5 | 31 | 19 | 22 | 6 | 08 | 19 | 20 |
| | 12 | 5 | 00 | 18 | 24 | 5 | 16 | 18 | 51 | 5 | 50 | 18 | 39 | 5 | 32 | 19 | 22 | 6 | 09 | 19 | 20 |
| | 14 | 5 | 01 | 18 | 24 | 5 | 17 | 18 | 51 | 5 | 50 | 18 | 39 | 5 | 33 | 19 | 21 | 6 | 09 | 19 | 20 |
| | 16 | 5 | 02 | 18 | 23 | 5 | 18 | 18 | 50 | 5 | 51 | 18 | 39 | 5 | 34 | 19 | 21 | 6 | 10 | 19 | 19 |
| | 18 | 5 | 03 | 18 | 23 | 5 | 19 | 18 | 50 | 5 | 52 | 18 | 39 | 5 | 35 | 19 | 20 | 6 | 11 | 19 | 19 |
| | 20 | 5 | 03 | 18 | 22 | 5 | 20 | 18 | 49 | 5 | 52 | 18 | 39 | 5 | 36 | 19 | 19 | 6 | 12 | 19 | 19 |
| | 22 | 5 | 04 | 18 | 22 | 5 | 21 | 18 | 48 | 5 | 53 | 18 | 38 | 5 | 37 | 19 | 18 | 6 | 12 | 19 | 18 |
| | 24 | 5 | 05 | 18 | 21 | 5 | 22 | 18 | 47 | 5 | 53 | 18 | 38 | 5 | 39 | 19 | 17 | 6 | 13 | 19 | 17 |
| | 26 | 5 | 06 | 18 | 20 | 5 | 23 | 18 | 46 | 5 | 54 | 18 | 38 | 5 | 40 | 19 | 16 | 6 | 14 | 19 | 17 |
| | 28 | 5 | 07 | 18 | 19 | 5 | 24 | 18 | 45 | 5 | 54 | 18 | 37 | 5 | 41 | 19 | 15 | 6 | 14 | 19 | 16 |
| | 30 | 5 | 08 | 18 | 18 | 5 | 25 | 18 | 44 | 5 | 54 | 18 | 36 | 5 | 42 | 19 | 13 | 6 | 15 | 19 | 15 |
| Aug. | 1 | 5 | 09 | 18 | 17 | 5 | 26 | 18 | 43 | 5 | 55 | 18 | 36 | 5 | 43 | 19 | 12 | 6 | 16 | 19 | 14 |
| | 3 | 5 | 09 | 18 | 16 | 5 | 26 | 18 | 42 | 5 | 55 | 18 | 35 | 5 | 44 | 19 | 11 | 6 | 16 | 19 | 13 |
| | 5 | 5 | 10 | 18 | 15 | 5 | 27 | 18 | 40 | 5 | 56 | 18 | 34 | 5 | 45 | 19 | 09 | 6 | 17 | 19 | 12 |
| | 7 | 5 | 11 | 18 | 14 | 5 | 28 | 18 | 39 | 5 | 56 | 18 | 33 | 5 | 46 | 19 | 07 | 6 | 18 | 19 | 11 |
| | 9 | 5 | 12 | 18 | 12 | 5 | 29 | 18 | 37 | 5 | 56 | 18 | 33 | 5 | 48 | 19 | 06 | 6 | 18 | 19 | 10 |
| | 11 | 5 | 13 | 18 | 11 | 5 | 30 | 18 | 36 | 5 | 57 | 18 | 32 | 5 | 49 | 19 | 04 | 6 | 19 | 19 | 09 |
| | 13 | 5 | 13 | 18 | 10 | 5 | 31 | 18 | 34 | 5 | 57 | 18 | 31 | 5 | 50 | 19 | 02 | 6 | 19 | 19 | 07 |
| | 15 | 5 | 14 | 18 | 08 | 5 | 32 | 18 | 33 | 5 | 57 | 18 | 30 | 5 | 51 | 19 | 00 | 6 | 20 | 19 | 06 |
| | 17 | 5 | 15 | 18 | 07 | 5 | 33 | 18 | 31 | 5 | 57 | 18 | 29 | 5 | 52 | 18 | 58 | 6 | 20 | 19 | 05 |
| | 19 | 5 | 16 | 18 | 05 | 5 | 34 | 18 | 29 | 5 | 57 | 18 | 28 | 5 | 53 | 18 | 56 | 6 | 21 | 19 | 03 |
| | 21 | 5 | 16 | 18 | 03 | 5 | 35 | 18 | 27 | 5 | 58 | 18 | 26 | 5 | 54 | 18 | 54 | 6 | 21 | 19 | 02 |
| | 23 | 5 | 17 | 18 | 02 | 5 | 35 | 18 | 25 | 5 | 58 | 18 | 25 | 5 | 55 | 18 | 52 | 6 | 22 | 19 | 00 |
| | 25 | 5 | 18 | 17 | 60 | 5 | 36 | 18 | 24 | 5 | 58 | 18 | 24 | 5 | 56 | 18 | 50 | 6 | 22 | 18 | 59 |
| | 27 | 5 | 18 | 17 | 58 | 5 | 37 | 18 | 22 | 5 | 58 | 18 | 23 | 5 | 57 | 18 | 48 | 6 | 23 | 18 | 57 |
| | 29 | 5 | 19 | 17 | 56 | 5 | 38 | 18 | 20 | 5 | 58 | 18 | 22 | 5 | 58 | 18 | 46 | 6 | 23 | 18 | 56 |
| | 31 | 5 | 19 | 17 | 55 | 5 | 39 | 18 | 18 | 5 | 58 | 18 | 20 | 5 | 59 | 18 | 43 | 6 | 24 | 18 | 54 |
| Sept. | 2 | 5 | 20 | 17 | 53 | 5 | 39 | 18 | 16 | 5 | 58 | 18 | 19 | 5 | 60 | 18 | 41 | 6 | 24 | 18 | 52 |
| | 4 | 5 | 21 | 17 | 51 | 5 | 40 | 18 | 14 | 5 | 58 | 18 | 18 | 6 | 01 | 18 | 39 | 6 | 24 | 18 | 51 |
| | 6 | 5 | 21 | 17 | 49 | 5 | 41 | 18 | 11 | 5 | 58 | 18 | 16 | 6 | 02 | 18 | 37 | 6 | 25 | 18 | 49 |
| | 8 | 5 | 22 | 17 | 47 | 5 | 42 | 18 | 09 | 5 | 58 | 18 | 15 | 6 | 03 | 18 | 34 | 6 | 25 | 18 | 47 |
| | 10 | 5 | 22 | 17 | 45 | 5 | 42 | 18 | 07 | 5 | 58 | 18 | 13 | 6 | 04 | 18 | 32 | 6 | 25 | 18 | 45 |
| | 12 | 5 | 23 | 17 | 43 | 5 | 43 | 18 | 05 | 5 | 58 | 18 | 12 | 6 | 05 | 18 | 29 | 6 | 26 | 18 | 44 |
| | 14 | 5 | 24 | 17 | 41 | 5 | 44 | 18 | 03 | 5 | 58 | 18 | 11 | 6 | 06 | 18 | 27 | 6 | 26 | 18 | 42 |
| | 16 | 5 | 24 | 17 | 39 | 5 | 45 | 18 | 01 | 5 | 58 | 18 | 09 | 6 | 07 | 18 | 25 | 6 | 26 | 18 | 40 |
| | 18 | 5 | 25 | 17 | 37 | 5 | 45 | 17 | 59 | 5 | 58 | 18 | 08 | 6 | 08 | 18 | 22 | 6 | 27 | 18 | 38 |
| | 20 | 5 | 25 | 17 | 35 | 5 | 46 | 17 | 57 | 5 | 58 | 18 | 06 | 6 | 09 | 18 | 20 | 6 | 27 | 18 | 36 |
| | 22 | 5 | 26 | 17 | 33 | 5 | 47 | 17 | 54 | 5 | 58 | 18 | 05 | 6 | 10 | 18 | 17 | 6 | 28 | 18 | 35 |
| | 24 | 5 | 26 | 17 | 31 | 5 | 48 | 17 | 52 | 5 | 58 | 18 | 04 | 6 | 11 | 18 | 15 | 6 | 28 | 18 | 33 |
| | 26 | 5 | 27 | 17 | 29 | 5 | 49 | 17 | 50 | 5 | 58 | 18 | 02 | 6 | 12 | 18 | 13 | 6 | 28 | 18 | 31 |
| | 28 | 5 | 28 | 17 | 27 | 5 | 49 | 17 | 48 | 5 | 59 | 18 | 01 | 6 | 13 | 18 | 10 | 6 | 29 | 18 | 29 |
| | 30 | 5 | 28 | 17 | 25 | 5 | 50 | 17 | 46 | 5 | 59 | 17 | 59 | 6 | 14 | 18 | 08 | 6 | 29 | 18 | 28 |
| Oct. | 2 | 5 | 29 | 17 | 23 | 5 | 51 | 17 | 44 | 5 | 59 | 17 | 58 | 6 | 15 | 18 | 06 | 6 | 30 | 18 | 26 |
| | 4 | 5 | 30 | 17 | 21 | 5 | 52 | 17 | 42 | 5 | 59 | 17 | 57 | 6 | 16 | 18 | 03 | 6 | 30 | 18 | 24 |
| | 6 | 5 | 30 | 17 | 20 | 5 | 53 | 17 | 40 | 5 | 59 | 17 | 55 | 6 | 17 | 18 | 01 | 6 | 30 | 18 | 22 |
| | 8 | 5 | 31 | 17 | 18 | 5 | 53 | 17 | 38 | 5 | 59 | 17 | 54 | 6 | 18 | 17 | 59 | 6 | 31 | 18 | 21 |

**SUNRISE AND SUNSET, 2021**

INDIAN STANDARD TIME OF SUNRISE AND SUNSET (SUN'S UPPER LIMB)
FOR CERTAIN STATIONS IN INDIA

| Date | | Kolkata 22º N 32' | | | | Varanasi 25º N 18' | | | | Chennai 13º N 00' | | | | Delhi 28º N 35' | | | | Mumbai 18º N 54' | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rise | | Set | | Rise | | Set | | Rise | | Set | | Rise | | Set | | Rise | | Set | |
| | | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m |
| Oct. | 10 | 5 | 32 | 17 | 16 | 5 | 54 | 17 | 36 | 5 | 59 | 17 | 53 | 6 | 19 | 17 | 57 | 6 | 31 | 18 | 19 |
| | 12 | 5 | 32 | 17 | 14 | 5 | 55 | 17 | 34 | 5 | 59 | 17 | 52 | 6 | 20 | 17 | 55 | 6 | 32 | 18 | 18 |
| | 14 | 5 | 33 | 17 | 12 | 5 | 56 | 17 | 32 | 5 | 60 | 17 | 51 | 6 | 21 | 17 | 53 | 6 | 33 | 18 | 16 |
| | 16 | 5 | 34 | 17 | 11 | 5 | 57 | 17 | 30 | 5 | 60 | 17 | 50 | 6 | 23 | 17 | 50 | 6 | 33 | 18 | 15 |
| | 18 | 5 | 35 | 17 | 09 | 5 | 58 | 17 | 28 | 6 | 00 | 17 | 48 | 6 | 24 | 17 | 48 | 6 | 34 | 18 | 13 |
| | 20 | 5 | 36 | 17 | 07 | 5 | 59 | 17 | 26 | 6 | 00 | 17 | 47 | 6 | 25 | 17 | 47 | 6 | 34 | 18 | 12 |
| | 22 | 5 | 37 | 17 | 06 | 6 | 00 | 17 | 25 | 6 | 01 | 17 | 46 | 6 | 26 | 17 | 45 | 6 | 35 | 18 | 11 |
| | 24 | 5 | 38 | 17 | 04 | 6 | 01 | 17 | 23 | 6 | 01 | 17 | 46 | 6 | 28 | 17 | 43 | 6 | 36 | 18 | 09 |
| | 26 | 5 | 39 | 17 | 03 | 6 | 02 | 17 | 21 | 6 | 02 | 17 | 45 | 6 | 29 | 17 | 41 | 6 | 37 | 18 | 08 |
| | 28 | 5 | 40 | 17 | 02 | 6 | 04 | 17 | 20 | 6 | 02 | 17 | 44 | 6 | 30 | 17 | 39 | 6 | 37 | 18 | 07 |
| | 30 | 5 | 41 | 17 | 00 | 6 | 05 | 17 | 18 | 6 | 02 | 17 | 43 | 6 | 32 | 17 | 38 | 6 | 38 | 18 | 06 |
| Nov. | 1 | 5 | 42 | 16 | 59 | 6 | 06 | 17 | 17 | 6 | 03 | 17 | 42 | 6 | 33 | 17 | 36 | 6 | 39 | 18 | 05 |
| | 3 | 5 | 43 | 16 | 58 | 6 | 07 | 17 | 16 | 6 | 04 | 17 | 42 | 6 | 35 | 17 | 35 | 6 | 40 | 18 | 04 |
| | 5 | 5 | 44 | 16 | 57 | 6 | 08 | 17 | 15 | 6 | 04 | 17 | 41 | 6 | 36 | 17 | 33 | 6 | 41 | 18 | 03 |
| | 7 | 5 | 45 | 16 | 56 | 6 | 10 | 17 | 13 | 6 | 05 | 17 | 41 | 6 | 38 | 17 | 32 | 6 | 42 | 18 | 03 |
| | 9 | 5 | 46 | 16 | 55 | 6 | 11 | 17 | 12 | 6 | 06 | 17 | 40 | 6 | 39 | 17 | 31 | 6 | 43 | 18 | 02 |
| | 11 | 5 | 47 | 16 | 54 | 6 | 12 | 17 | 11 | 6 | 06 | 17 | 40 | 6 | 41 | 17 | 29 | 6 | 44 | 18 | 01 |
| | 13 | 5 | 49 | 16 | 53 | 6 | 14 | 17 | 11 | 6 | 07 | 17 | 40 | 6 | 42 | 17 | 28 | 6 | 45 | 18 | 01 |
| | 15 | 5 | 50 | 16 | 53 | 6 | 15 | 17 | 10 | 6 | 08 | 17 | 39 | 6 | 44 | 17 | 27 | 6 | 46 | 18 | 00 |
| | 17 | 5 | 51 | 16 | 52 | 6 | 16 | 17 | 09 | 6 | 09 | 17 | 39 | 6 | 45 | 17 | 27 | 6 | 47 | 17 | 60 |
| | 19 | 5 | 52 | 16 | 52 | 6 | 18 | 17 | 09 | 6 | 10 | 17 | 39 | 6 | 47 | 17 | 26 | 6 | 48 | 17 | 60 |
| | 21 | 5 | 54 | 16 | 51 | 6 | 19 | 17 | 08 | 6 | 11 | 17 | 39 | 6 | 49 | 17 | 25 | 6 | 50 | 17 | 59 |
| | 23 | 5 | 55 | 16 | 51 | 6 | 21 | 17 | 08 | 6 | 12 | 17 | 39 | 6 | 50 | 17 | 25 | 6 | 51 | 17 | 59 |
| | 25 | 5 | 56 | 16 | 51 | 6 | 22 | 17 | 07 | 6 | 13 | 17 | 40 | 6 | 52 | 17 | 24 | 6 | 52 | 17 | 59 |
| | 27 | 5 | 58 | 16 | 51 | 6 | 24 | 17 | 07 | 6 | 14 | 17 | 40 | 6 | 54 | 17 | 24 | 6 | 53 | 17 | 59 |
| | 29 | 5 | 59 | 16 | 51 | 6 | 25 | 17 | 07 | 6 | 15 | 17 | 40 | 6 | 55 | 17 | 24 | 6 | 54 | 17 | 60 |
| Dec. | 1 | 6 | 00 | 16 | 51 | 6 | 27 | 17 | 07 | 6 | 16 | 17 | 41 | 6 | 57 | 17 | 24 | 6 | 56 | 17 | 60 |
| | 3 | 6 | 02 | 16 | 51 | 6 | 28 | 17 | 07 | 6 | 17 | 17 | 41 | 6 | 58 | 17 | 24 | 6 | 57 | 17 | 60 |
| | 5 | 6 | 03 | 16 | 52 | 6 | 29 | 17 | 08 | 6 | 18 | 17 | 42 | 6 | 60 | 17 | 24 | 6 | 58 | 18 | 00 |
| | 7 | 6 | 04 | 16 | 52 | 6 | 31 | 17 | 08 | 6 | 19 | 17 | 42 | 7 | 01 | 17 | 24 | 6 | 59 | 18 | 01 |
| | 9 | 6 | 05 | 16 | 53 | 6 | 32 | 17 | 08 | 6 | 20 | 17 | 43 | 7 | 03 | 17 | 25 | 7 | 01 | 18 | 01 |
| | 11 | 6 | 07 | 16 | 53 | 6 | 33 | 17 | 09 | 6 | 21 | 17 | 44 | 7 | 04 | 17 | 25 | 7 | 02 | 18 | 02 |
| | 13 | 6 | 08 | 16 | 54 | 6 | 35 | 17 | 09 | 6 | 22 | 17 | 44 | 7 | 05 | 17 | 26 | 7 | 03 | 18 | 03 |
| | 15 | 6 | 09 | 16 | 54 | 6 | 36 | 17 | 10 | 6 | 23 | 17 | 45 | 7 | 07 | 17 | 26 | 7 | 04 | 18 | 04 |
| | 17 | 6 | 10 | 16 | 55 | 6 | 37 | 17 | 11 | 6 | 24 | 17 | 46 | 7 | 08 | 17 | 27 | 7 | 05 | 18 | 04 |
| | 19 | 6 | 11 | 16 | 56 | 6 | 38 | 17 | 12 | 6 | 25 | 17 | 47 | 7 | 09 | 17 | 28 | 7 | 06 | 18 | 05 |
| | 21 | 6 | 12 | 16 | 57 | 6 | 39 | 17 | 13 | 6 | 26 | 17 | 48 | 7 | 10 | 17 | 29 | 7 | 07 | 18 | 06 |
| | 23 | 6 | 13 | 16 | 58 | 6 | 40 | 17 | 14 | 6 | 27 | 17 | 49 | 7 | 11 | 17 | 30 | 7 | 08 | 18 | 07 |
| | 25 | 6 | 14 | 16 | 59 | 6 | 41 | 17 | 15 | 6 | 28 | 17 | 50 | 7 | 12 | 17 | 31 | 7 | 09 | 18 | 08 |
| | 27 | 6 | 15 | 17 | 00 | 6 | 42 | 17 | 16 | 6 | 29 | 17 | 51 | 7 | 13 | 17 | 32 | 7 | 10 | 18 | 09 |
| | 29 | 6 | 16 | 17 | 02 | 6 | 43 | 17 | 17 | 6 | 30 | 17 | 52 | 7 | 14 | 17 | 33 | 7 | 11 | 18 | 10 |
| | 31 | 6 | 16 | 17 | 03 | 6 | 43 | 17 | 19 | 6 | 31 | 17 | 53 | 7 | 14 | 17 | 35 | 7 | 12 | 18 | 12 |
| | 33 | 6 | 17 | 17 | 04 | 6 | 44 | 17 | 20 | 6 | 32 | 17 | 54 | 7 | 15 | 17 | 36 | 7 | 13 | 18 | 13 |
| | 35 | 6 | 18 | 17 | 06 | 6 | 45 | 17 | 21 | 6 | 32 | 17 | 55 | 7 | 15 | 17 | 38 | 7 | 13 | 18 | 14 |
| | 37 | 6 | 18 | 17 | 07 | 6 | 45 | 17 | 23 | 6 | 33 | 17 | 56 | 7 | 15 | 17 | 39 | 7 | 14 | 18 | 15 |

**MOONRISE, 2021**

LOCAL MEAN TIME AND INDIAN STANDARD TIME OF MOONRISE (MOON'S UPPER LIMB)

| | FOR THE CENTRAL MERIDIAN OF INDIA ( 82º.5 E ) IN L. M. T. | | | | | | | | | | | | FOR CERTAIN STATIONS IN INDIA IN I.S.T. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date \ Lat. | 0º | | 10º | | 20º | | 30º | | 40º | | 50º | | Kolkata | | Chennai | | Delhi | | Mumbai | |
| | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m |
| Jan. 0 | 19 | 18 | 19 | 00 | 18 | 40 | 18 | 17 | 17 | 48 | 17 | 06 | 18 | 10 | 19 | 04 | 18 | 43 | 19 | 22 |
| 1 | 20 | 12 | 19 | 56 | 19 | 38 | 19 | 18 | 18 | 52 | 18 | 15 | 19 | 09 | 20 | 00 | 19 | 43 | 20 | 20 |
| 2 | 21 | 05 | 20 | 51 | 20 | 37 | 20 | 20 | 19 | 60 | 19 | 31 | 20 | 09 | 20 | 56 | 20 | 45 | 21 | 19 |
| 3 | 21 | 55 | 21 | 46 | 21 | 35 | 21 | 23 | 21 | 08 | 20 | 48 | 21 | 08 | 21 | 52 | 21 | 47 | 22 | 16 |
| 4 | 22 | 44 | 22 | 39 | 22 | 32 | 22 | 26 | 22 | 17 | 22 | 06 | 22 | 07 | 22 | 46 | 22 | 49 | 23 | 14 |
| 5 | 23 | 33 | 23 | 32 | 23 | 30 | 23 | 29 | 23 | 27 | 23 | 24 | 23 | 05 | 23 | 40 | 23 | 51 | ** | ** |
| 6 | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | 0 | 10 |
| 7 | 0 | 21 | 0 | 24 | 0 | 27 | 0 | 31 | 0 | 36 | 0 | 43 | 0 | 04 | 0 | 34 | 0 | 53 | 1 | 08 |
| 8 | 1 | 11 | 1 | 19 | 1 | 27 | 1 | 36 | 1 | 48 | 2 | 04 | 1 | 05 | 1 | 31 | 1 | 57 | 2 | 06 |
| 9 | 2 | 04 | 2 | 15 | 2 | 28 | 2 | 43 | 3 | 01 | 3 | 27 | 2 | 07 | 2 | 28 | 3 | 03 | 3 | 07 |
| 10 | 2 | 60 | 3 | 15 | 3 | 32 | 3 | 51 | 4 | 15 | 4 | 49 | 3 | 12 | 3 | 30 | 4 | 10 | 4 | 10 |
| 11 | 3 | 59 | 4 | 17 | 4 | 36 | 4 | 59 | 5 | 28 | 6 | 09 | 4 | 17 | 4 | 32 | 5 | 18 | 5 | 15 |
| 12 | 4 | 60 | 5 | 20 | 5 | 41 | 6 | 04 | 6 | 35 | 7 | 20 | 5 | 22 | 5 | 35 | 6 | 23 | 6 | 18 |
| 13 | 6 | 01 | 6 | 20 | 6 | 40 | 7 | 04 | 7 | 35 | 8 | 17 | 6 | 22 | 6 | 35 | 7 | 23 | 7 | 19 |
| 14 | 6 | 59 | 7 | 17 | 7 | 35 | 7 | 57 | 8 | 23 | 9 | 02 | 7 | 16 | 7 | 32 | 8 | 15 | 8 | 13 |
| 15 | 7 | 53 | 8 | 08 | 8 | 23 | 8 | 41 | 9 | 04 | 9 | 35 | 8 | 04 | 8 | 22 | 9 | 01 | 9 | 02 |
| 16 | 8 | 43 | 8 | 55 | 9 | 07 | 9 | 21 | 9 | 37 | 10 | 00 | 8 | 46 | 9 | 08 | 9 | 40 | 9 | 45 |
| 17 | 9 | 30 | 9 | 37 | 9 | 45 | 9 | 54 | 10 | 05 | 10 | 20 | 9 | 24 | 9 | 49 | 10 | 14 | 10 | 24 |
| 18 | 10 | 13 | 10 | 16 | 10 | 20 | 10 | 25 | 10 | 31 | 10 | 38 | 9 | 58 | 10 | 27 | 10 | 46 | 11 | 00 |
| 19 | 10 | 54 | 10 | 54 | 10 | 54 | 10 | 54 | 10 | 54 | 10 | 54 | 10 | 30 | 11 | 03 | 11 | 16 | 11 | 34 |
| 20 | 11 | 35 | 11 | 32 | 11 | 28 | 11 | 23 | 11 | 18 | 11 | 10 | 11 | 02 | 11 | 40 | 11 | 45 | 12 | 07 |
| 21 | 12 | 16 | 12 | 09 | 12 | 01 | 11 | 52 | 11 | 41 | 11 | 27 | 11 | 35 | 12 | 15 | 12 | 15 | 12 | 41 |
| 22 | 12 | 58 | 12 | 47 | 12 | 36 | 12 | 23 | 12 | 07 | 11 | 45 | 12 | 09 | 12 | 53 | 12 | 46 | 13 | 17 |
| 23 | 13 | 43 | 13 | 29 | 13 | 14 | 12 | 57 | 12 | 36 | 12 | 07 | 12 | 46 | 13 | 34 | 13 | 21 | 13 | 55 |
| 24 | 14 | 30 | 14 | 13 | 13 | 56 | 13 | 36 | 13 | 10 | 12 | 34 | 13 | 27 | 14 | 17 | 14 | 00 | 14 | 37 |
| 25 | 15 | 21 | 15 | 02 | 14 | 42 | 14 | 19 | 13 | 51 | 13 | 10 | 14 | 12 | 15 | 05 | 14 | 44 | 15 | 24 |
| 26 | 16 | 13 | 15 | 54 | 15 | 33 | 15 | 09 | 14 | 39 | 13 | 55 | 15 | 03 | 15 | 57 | 15 | 35 | 16 | 15 |
| 27 | 17 | 08 | 16 | 49 | 16 | 28 | 16 | 05 | 15 | 35 | 14 | 52 | 15 | 59 | 16 | 52 | 16 | 30 | 17 | 11 |
| 28 | 18 | 03 | 17 | 46 | 17 | 27 | 17 | 06 | 16 | 38 | 15 | 59 | 16 | 58 | 17 | 50 | 17 | 31 | 18 | 09 |
| 29 | 18 | 57 | 18 | 43 | 18 | 27 | 18 | 09 | 17 | 47 | 17 | 14 | 17 | 59 | 18 | 47 | 18 | 33 | 19 | 09 |
| 30 | 19 | 50 | 19 | 39 | 19 | 27 | 19 | 14 | 18 | 57 | 18 | 33 | 19 | 00 | 19 | 45 | 19 | 38 | 20 | 08 |
| 31 | 20 | 41 | 20 | 34 | 20 | 26 | 20 | 18 | 20 | 07 | 19 | 53 | 20 | 00 | 20 | 41 | 20 | 41 | 21 | 07 |
| Feb. 1 | 21 | 30 | 21 | 28 | 21 | 25 | 21 | 22 | 21 | 18 | 21 | 13 | 21 | 00 | 21 | 36 | 21 | 44 | 22 | 05 |
| 2 | 22 | 19 | 22 | 21 | 22 | 23 | 22 | 25 | 22 | 28 | 22 | 33 | 21 | 59 | 22 | 31 | 22 | 47 | 23 | 03 |
| 3 | 23 | 09 | 23 | 15 | 23 | 22 | 23 | 30 | 23 | 40 | 23 | 53 | 22 | 59 | 23 | 27 | 23 | 51 | ** | ** |
| 4 | 23 | 60 | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | 0 | 01 |
| 5 | ** | ** | 0 | 10 | 0 | 22 | 0 | 35 | 0 | 51 | 1 | 15 | 0 | 01 | 0 | 23 | 0 | 55 | 1 | 01 |
| 6 | 0 | 53 | 1 | 08 | 1 | 24 | 1 | 42 | 2 | 04 | 2 | 36 | 1 | 03 | 1 | 22 | 2 | 01 | 2 | 02 |
| 7 | 1 | 50 | 2 | 07 | 2 | 26 | 2 | 48 | 3 | 15 | 3 | 55 | 2 | 07 | 2 | 22 | 3 | 07 | 3 | 04 |
| 8 | 2 | 49 | 3 | 08 | 3 | 29 | 3 | 53 | 4 | 23 | 5 | 07 | 3 | 10 | 3 | 24 | 4 | 11 | 4 | 06 |
| 9 | 3 | 48 | 4 | 08 | 4 | 28 | 4 | 53 | 5 | 24 | 6 | 08 | 4 | 10 | 4 | 23 | 5 | 11 | 5 | 07 |
| 10 | 4 | 46 | 5 | 05 | 5 | 25 | 5 | 47 | 6 | 15 | 6 | 56 | 5 | 06 | 5 | 20 | 6 | 05 | 6 | 02 |
| 11 | 5 | 42 | 5 | 58 | 6 | 14 | 6 | 34 | 6 | 59 | 7 | 33 | 5 | 55 | 6 | 12 | 6 | 53 | 6 | 53 |
| 12 | 6 | 33 | 6 | 46 | 6 | 60 | 7 | 15 | 7 | 35 | 8 | 01 | 6 | 39 | 6 | 59 | 7 | 35 | 7 | 38 |
| 13 | 7 | 21 | 7 | 30 | 7 | 40 | 7 | 51 | 8 | 05 | 8 | 23 | 7 | 19 | 7 | 43 | 8 | 11 | 8 | 18 |
| 14 | 8 | 06 | 8 | 11 | 8 | 17 | 8 | 23 | 8 | 31 | 8 | 42 | 7 | 54 | 8 | 22 | 8 | 44 | 8 | 56 |
| 15 | 8 | 48 | 8 | 50 | 8 | 51 | 8 | 53 | 8 | 55 | 8 | 58 | 8 | 28 | 8 | 59 | 9 | 15 | 9 | 31 |

The symbol (**) indicates that the phenomenon will occur on the next day

**MOONSET, 2021**
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONSET (MOON'S UPPER LIMB)

| | FOR THE CENTRAL MERIDIAN OF INDIA ( 82°.5 E ) IN L. M. T. | | | | | | | | | | | | FOR CERTAIN STATIONS IN INDIA IN I.S.T. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date \ Lat. | 0° | | 10° | | 20° | | 30° | | 40° | | 50° | | Kolkata | | Chennai | | Delhi | | Mumbai | |
| | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m |
| Jan. 0 | 6 | 50 | 7 | 09 | 7 | 30 | 7 | 53 | 8 | 23 | 9 | 06 | 7 | 11 | 7 | 25 | 8 | 12 | 8 | 08 |
| 1 | 7 | 45 | 8 | 02 | 8 | 21 | 8 | 42 | 9 | 09 | 9 | 48 | 8 | 02 | 8 | 17 | 9 | 01 | 8 | 59 |
| 2 | 8 | 38 | 8 | 53 | 9 | 09 | 9 | 27 | 9 | 50 | 10 | 21 | 8 | 49 | 9 | 07 | 9 | 46 | 9 | 47 |
| 3 | 9 | 29 | 9 | 41 | 9 | 53 | 10 | 07 | 10 | 24 | 10 | 48 | 9 | 33 | 9 | 54 | 10 | 27 | 10 | 31 |
| 4 | 10 | 19 | 10 | 26 | 10 | 34 | 10 | 44 | 10 | 55 | 11 | 10 | 10 | 13 | 10 | 38 | 11 | 04 | 11 | 14 |
| 5 | 11 | 07 | 11 | 11 | 11 | 15 | 11 | 19 | 11 | 24 | 11 | 30 | 10 | 51 | 11 | 21 | 11 | 40 | 11 | 54 |
| 6 | 11 | 56 | 11 | 55 | 11 | 54 | 11 | 53 | 11 | 51 | 11 | 49 | 11 | 30 | 12 | 04 | 12 | 14 | 12 | 33 |
| 7 | 12 | 45 | 12 | 39 | 12 | 33 | 12 | 27 | 12 | 19 | 12 | 09 | 12 | 08 | 12 | 47 | 12 | 50 | 13 | 14 |
| 8 | 13 | 36 | 13 | 26 | 13 | 16 | 13 | 04 | 12 | 50 | 12 | 30 | 12 | 49 | 13 | 33 | 13 | 28 | 13 | 57 |
| 9 | 14 | 30 | 14 | 16 | 14 | 02 | 13 | 46 | 13 | 25 | 12 | 57 | 13 | 34 | 14 | 21 | 14 | 09 | 14 | 43 |
| 10 | 15 | 28 | 15 | 11 | 14 | 53 | 14 | 32 | 14 | 06 | 13 | 30 | 14 | 24 | 15 | 15 | 14 | 57 | 15 | 35 |
| 11 | 16 | 28 | 16 | 09 | 15 | 49 | 15 | 26 | 14 | 56 | 14 | 13 | 15 | 19 | 16 | 12 | 15 | 51 | 16 | 31 |
| 12 | 17 | 30 | 17 | 10 | 16 | 49 | 16 | 24 | 15 | 54 | 15 | 09 | 16 | 18 | 17 | 13 | 16 | 50 | 17 | 32 |
| 13 | 18 | 29 | 18 | 10 | 17 | 51 | 17 | 28 | 16 | 58 | 16 | 16 | 17 | 21 | 18 | 14 | 17 | 53 | 18 | 33 |
| 14 | 19 | 26 | 19 | 09 | 18 | 52 | 18 | 31 | 18 | 06 | 17 | 30 | 18 | 22 | 19 | 14 | 18 | 56 | 19 | 34 |
| 15 | 20 | 18 | 20 | 05 | 19 | 51 | 19 | 35 | 19 | 14 | 18 | 45 | 19 | 23 | 20 | 10 | 19 | 59 | 20 | 32 |
| 16 | 21 | 06 | 20 | 56 | 20 | 46 | 20 | 34 | 20 | 19 | 19 | 59 | 20 | 19 | 21 | 03 | 20 | 58 | 21 | 27 |
| 17 | 21 | 51 | 21 | 45 | 21 | 39 | 21 | 32 | 21 | 23 | 21 | 11 | 21 | 13 | 21 | 52 | 21 | 55 | 22 | 19 |
| 18 | 22 | 32 | 22 | 31 | 22 | 28 | 22 | 26 | 22 | 23 | 22 | 19 | 22 | 04 | 22 | 39 | 22 | 48 | 23 | 09 |
| 19 | 23 | 14 | 23 | 16 | 23 | 18 | 23 | 20 | 23 | 23 | 23 | 27 | 22 | 54 | 23 | 26 | 23 | 42 | 23 | 57 |
| 20 | 23 | 54 | 23 | 60 | ** | ** | ** | ** | ** | ** | ** | ** | 23 | 44 | ** | ** | ** | ** | ** | ** |
| 21 | ** | ** | ** | ** | 0 | 06 | 0 | 13 | 0 | 21 | 0 | 33 | ** | ** | 0 | 11 | 0 | 33 | 0 | 45 |
| 22 | 0 | 36 | 0 | 45 | 0 | 55 | 1 | 06 | 1 | 20 | 1 | 40 | 0 | 33 | 0 | 57 | 1 | 27 | 1 | 34 |
| 23 | 1 | 19 | 1 | 32 | 1 | 45 | 2 | 00 | 2 | 19 | 2 | 46 | 1 | 25 | 1 | 45 | 2 | 20 | 2 | 23 |
| 24 | 2 | 05 | 2 | 20 | 2 | 37 | 2 | 56 | 3 | 20 | 3 | 54 | 2 | 17 | 2 | 34 | 3 | 15 | 3 | 15 |
| 25 | 2 | 54 | 3 | 12 | 3 | 31 | 3 | 53 | 4 | 20 | 4 | 60 | 3 | 12 | 3 | 27 | 4 | 11 | 4 | 08 |
| 26 | 3 | 46 | 4 | 04 | 4 | 25 | 4 | 49 | 5 | 19 | 6 | 02 | 4 | 06 | 4 | 20 | 5 | 07 | 5 | 03 |
| 27 | 4 | 39 | 4 | 59 | 5 | 20 | 5 | 44 | 6 | 14 | 6 | 58 | 5 | 01 | 5 | 14 | 6 | 02 | 5 | 57 |
| 28 | 5 | 35 | 5 | 53 | 6 | 12 | 6 | 35 | 7 | 03 | 7 | 44 | 5 | 54 | 6 | 08 | 6 | 54 | 6 | 50 |
| 29 | 6 | 29 | 6 | 45 | 7 | 03 | 7 | 22 | 7 | 47 | 8 | 20 | 6 | 43 | 7 | 00 | 7 | 41 | 7 | 41 |
| 30 | 7 | 23 | 7 | 36 | 7 | 50 | 8 | 05 | 8 | 24 | 8 | 50 | 7 | 29 | 7 | 49 | 8 | 24 | 8 | 28 |
| 31 | 8 | 14 | 8 | 23 | 8 | 33 | 8 | 44 | 8 | 57 | 9 | 15 | 8 | 11 | 8 | 35 | 9 | 04 | 9 | 12 |
| Feb. 1 | 9 | 04 | 9 | 09 | 9 | 14 | 9 | 20 | 9 | 27 | 9 | 36 | 8 | 51 | 9 | 20 | 9 | 41 | 9 | 53 |
| 2 | 9 | 54 | 9 | 54 | 9 | 54 | 9 | 54 | 9 | 55 | 9 | 55 | 9 | 30 | 10 | 03 | 10 | 16 | 10 | 33 |
| 3 | 10 | 42 | 10 | 38 | 10 | 34 | 10 | 29 | 10 | 22 | 10 | 14 | 10 | 08 | 10 | 46 | 10 | 51 | 11 | 14 |
| 4 | 11 | 33 | 11 | 24 | 11 | 15 | 11 | 05 | 10 | 52 | 10 | 35 | 10 | 48 | 11 | 31 | 11 | 28 | 11 | 56 |
| 5 | 12 | 25 | 12 | 12 | 11 | 59 | 11 | 44 | 11 | 25 | 10 | 59 | 11 | 32 | 12 | 18 | 12 | 08 | 12 | 40 |
| 6 | 13 | 20 | 13 | 04 | 12 | 47 | 12 | 27 | 12 | 03 | 11 | 29 | 12 | 18 | 13 | 09 | 12 | 52 | 13 | 29 |
| 7 | 14 | 18 | 13 | 59 | 13 | 40 | 13 | 17 | 12 | 48 | 12 | 07 | 13 | 10 | 14 | 03 | 13 | 42 | 14 | 22 |
| 8 | 15 | 17 | 14 | 58 | 14 | 36 | 14 | 12 | 13 | 42 | 12 | 57 | 14 | 06 | 15 | 01 | 14 | 38 | 15 | 19 |
| 9 | 16 | 16 | 15 | 57 | 15 | 37 | 15 | 13 | 14 | 42 | 13 | 58 | 15 | 06 | 16 | 00 | 15 | 38 | 16 | 19 |
| 10 | 17 | 13 | 16 | 56 | 16 | 37 | 16 | 15 | 15 | 48 | 15 | 09 | 16 | 07 | 17 | 00 | 16 | 40 | 17 | 19 |
| 11 | 18 | 07 | 17 | 52 | 17 | 37 | 17 | 18 | 16 | 55 | 16 | 23 | 17 | 08 | 17 | 57 | 17 | 43 | 18 | 18 |
| 12 | 18 | 56 | 18 | 45 | 18 | 33 | 18 | 19 | 18 | 02 | 17 | 39 | 18 | 06 | 18 | 51 | 18 | 43 | 19 | 15 |
| 13 | 19 | 43 | 19 | 35 | 19 | 28 | 19 | 18 | 19 | 07 | 18 | 51 | 19 | 01 | 19 | 42 | 19 | 42 | 20 | 08 |
| 14 | 20 | 26 | 20 | 22 | 20 | 19 | 20 | 14 | 20 | 09 | 20 | 02 | 19 | 54 | 20 | 31 | 20 | 37 | 20 | 59 |
| 15 | 21 | 08 | 21 | 08 | 21 | 09 | 21 | 09 | 21 | 10 | 21 | 11 | 20 | 45 | 21 | 18 | 21 | 31 | 21 | 49 |

The symbol (**) indicates that the phenomenon will occur on the next day

**MOONRISE, 2021**

LOCAL MEAN TIME AND INDIAN STANDARD TIME OF MOONRISE (MOON'S UPPER LIMB)

| FOR THE CENTRAL MERIDIAN OF INDIA ( 82º.5 E ) IN L. M. T. | | | | | | | | | | | | | FOR CERTAIN STATIONS IN INDIA IN I.S.T. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date \ Lat. | 0º | | 10º | | 20º | | 30º | | 40º | | 50º | | Kolkata | | Chennai | | Delhi | | Mumbai | |
| | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m |
| Feb. 15 | 8 | 48 | 8 | 50 | 8 | 51 | 8 | 53 | 8 | 55 | 8 | 58 | 8 | 28 | 8 | 59 | 9 | 15 | 9 | 31 |
| 16 | 9 | 30 | 9 | 27 | 9 | 25 | 9 | 22 | 9 | 19 | 9 | 14 | 9 | 00 | 9 | 36 | 9 | 44 | 10 | 04 |
| 17 | 10 | 10 | 10 | 05 | 9 | 58 | 9 | 51 | 9 | 42 | 9 | 31 | 9 | 33 | 10 | 12 | 10 | 13 | 10 | 38 |
| 18 | 10 | 52 | 10 | 43 | 10 | 32 | 10 | 21 | 10 | 07 | 9 | 48 | 10 | 06 | 10 | 49 | 10 | 44 | 11 | 14 |
| 19 | 11 | 36 | 11 | 23 | 11 | 09 | 10 | 54 | 10 | 34 | 10 | 08 | 10 | 41 | 11 | 28 | 11 | 18 | 11 | 51 |
| 20 | 12 | 21 | 12 | 06 | 11 | 49 | 11 | 30 | 11 | 06 | 10 | 33 | 11 | 21 | 12 | 10 | 11 | 54 | 12 | 30 |
| 21 | 13 | 10 | 12 | 52 | 12 | 33 | 12 | 11 | 11 | 43 | 11 | 04 | 12 | 03 | 12 | 55 | 12 | 35 | 13 | 15 |
| 22 | 14 | 01 | 13 | 42 | 13 | 21 | 12 | 57 | 12 | 27 | 11 | 44 | 12 | 51 | 13 | 45 | 13 | 23 | 14 | 03 |
| 23 | 14 | 55 | 14 | 35 | 14 | 14 | 13 | 50 | 13 | 20 | 12 | 35 | 13 | 44 | 14 | 38 | 14 | 15 | 14 | 57 |
| 24 | 15 | 50 | 15 | 31 | 15 | 11 | 14 | 48 | 14 | 19 | 13 | 38 | 14 | 41 | 15 | 35 | 15 | 14 | 15 | 54 |
| 25 | 16 | 44 | 16 | 28 | 16 | 11 | 15 | 51 | 15 | 26 | 14 | 50 | 15 | 42 | 16 | 32 | 16 | 16 | 16 | 53 |
| 26 | 17 | 39 | 17 | 26 | 17 | 12 | 16 | 56 | 16 | 36 | 16 | 09 | 16 | 43 | 17 | 31 | 17 | 21 | 17 | 54 |
| 27 | 18 | 30 | 18 | 22 | 18 | 12 | 18 | 02 | 17 | 49 | 17 | 31 | 17 | 46 | 18 | 28 | 18 | 25 | 18 | 54 |
| 28 | 19 | 22 | 19 | 18 | 19 | 13 | 19 | 08 | 19 | 02 | 18 | 53 | 18 | 47 | 19 | 26 | 19 | 31 | 19 | 54 |
| Mar. 1 | 20 | 12 | 20 | 13 | 20 | 13 | 20 | 14 | 20 | 14 | 20 | 15 | 19 | 49 | 20 | 22 | 20 | 36 | 20 | 53 |
| 2 | 21 | 03 | 21 | 08 | 21 | 14 | 21 | 20 | 21 | 28 | 21 | 39 | 20 | 51 | 21 | 19 | 21 | 41 | 21 | 54 |
| 3 | 21 | 55 | 22 | 05 | 22 | 15 | 22 | 27 | 22 | 41 | 23 | 02 | 21 | 54 | 22 | 17 | 22 | 47 | 22 | 54 |
| 4 | 22 | 49 | 23 | 03 | 23 | 18 | 23 | 35 | 23 | 56 | ** | ** | 22 | 57 | 23 | 17 | 23 | 54 | 23 | 56 |
| 5 | 23 | 46 | ** | ** | ** | ** | ** | ** | ** | ** | 0 | 25 | ** | ** | ** | ** | ** | ** | ** | ** |
| 6 | ** | ** | 0 | 02 | 0 | 20 | 0 | 41 | 1 | 08 | 1 | 47 | 0 | 01 | 0 | 17 | 1 | 01 | 0 | 59 |
| 7 | 0 | 44 | 1 | 03 | 1 | 23 | 1 | 47 | 2 | 17 | 3 | 01 | 1 | 04 | 1 | 18 | 2 | 05 | 2 | 01 |
| 8 | 1 | 43 | 2 | 02 | 2 | 23 | 2 | 48 | 3 | 19 | 4 | 04 | 2 | 05 | 2 | 18 | 3 | 06 | 3 | 01 |
| 9 | 2 | 40 | 2 | 59 | 3 | 20 | 3 | 43 | 4 | 13 | 4 | 55 | 3 | 01 | 3 | 15 | 4 | 01 | 3 | 57 |
| 10 | 3 | 35 | 3 | 52 | 4 | 10 | 4 | 31 | 4 | 57 | 5 | 35 | 3 | 51 | 4 | 07 | 4 | 50 | 4 | 48 |
| 11 | 4 | 27 | 4 | 41 | 4 | 56 | 5 | 13 | 5 | 35 | 6 | 04 | 4 | 36 | 4 | 55 | 5 | 33 | 5 | 34 |
| 12 | 5 | 15 | 5 | 26 | 5 | 37 | 5 | 50 | 6 | 06 | 6 | 27 | 5 | 16 | 5 | 39 | 6 | 10 | 6 | 15 |
| 13 | 6 | 00 | 6 | 07 | 6 | 14 | 6 | 23 | 6 | 33 | 6 | 47 | 5 | 53 | 6 | 18 | 6 | 43 | 6 | 53 |
| 14 | 6 | 43 | 6 | 46 | 6 | 50 | 6 | 53 | 6 | 58 | 7 | 04 | 6 | 26 | 6 | 57 | 7 | 14 | 7 | 29 |
| 15 | 7 | 25 | 7 | 24 | 7 | 23 | 7 | 22 | 7 | 21 | 7 | 20 | 6 | 59 | 7 | 33 | 7 | 44 | 8 | 03 |
| 16 | 8 | 06 | 8 | 01 | 7 | 57 | 7 | 51 | 7 | 44 | 7 | 35 | 7 | 32 | 8 | 09 | 8 | 13 | 8 | 36 |
| 17 | 8 | 48 | 8 | 39 | 8 | 30 | 8 | 20 | 8 | 08 | 7 | 52 | 8 | 04 | 8 | 46 | 8 | 43 | 9 | 11 |
| 18 | 9 | 31 | 9 | 19 | 9 | 06 | 8 | 52 | 8 | 34 | 8 | 10 | 8 | 39 | 9 | 24 | 9 | 16 | 9 | 47 |
| 19 | 10 | 15 | 10 | 00 | 9 | 45 | 9 | 27 | 9 | 04 | 8 | 33 | 9 | 16 | 10 | 05 | 9 | 51 | 10 | 26 |
| 20 | 11 | 02 | 10 | 44 | 10 | 26 | 10 | 05 | 9 | 38 | 9 | 01 | 9 | 57 | 10 | 48 | 10 | 29 | 11 | 08 |
| 21 | 11 | 52 | 11 | 33 | 11 | 12 | 10 | 48 | 10 | 18 | 9 | 36 | 10 | 42 | 11 | 36 | 11 | 14 | 11 | 54 |
| 22 | 12 | 43 | 12 | 23 | 12 | 02 | 11 | 38 | 11 | 07 | 10 | 21 | 11 | 32 | 12 | 26 | 12 | 03 | 12 | 44 |
| 23 | 13 | 37 | 13 | 17 | 12 | 56 | 12 | 32 | 12 | 02 | 11 | 18 | 12 | 26 | 13 | 20 | 12 | 58 | 13 | 39 |
| 24 | 14 | 30 | 14 | 12 | 13 | 54 | 13 | 32 | 13 | 05 | 12 | 25 | 13 | 25 | 14 | 16 | 13 | 57 | 14 | 36 |
| 25 | 15 | 24 | 15 | 09 | 14 | 53 | 14 | 35 | 14 | 12 | 13 | 41 | 14 | 24 | 15 | 14 | 15 | 00 | 15 | 36 |
| 26 | 16 | 16 | 16 | 05 | 15 | 54 | 15 | 41 | 15 | 24 | 15 | 00 | 15 | 26 | 16 | 11 | 16 | 04 | 16 | 35 |
| 27 | 17 | 08 | 17 | 02 | 16 | 55 | 16 | 46 | 16 | 36 | 16 | 23 | 16 | 28 | 17 | 09 | 17 | 10 | 17 | 36 |
| 28 | 17 | 60 | 17 | 58 | 17 | 56 | 17 | 54 | 17 | 51 | 17 | 47 | 17 | 31 | 18 | 06 | 18 | 16 | 18 | 36 |
| 29 | 18 | 51 | 18 | 54 | 18 | 57 | 19 | 01 | 19 | 06 | 19 | 12 | 18 | 34 | 19 | 05 | 19 | 23 | 19 | 38 |
| 30 | 19 | 45 | 19 | 52 | 20 | 00 | 20 | 10 | 20 | 22 | 20 | 38 | 19 | 39 | 20 | 04 | 20 | 30 | 20 | 40 |
| 31 | 20 | 39 | 20 | 52 | 21 | 05 | 21 | 20 | 21 | 39 | 22 | 05 | 20 | 44 | 21 | 05 | 21 | 40 | 21 | 44 |
| Apr. 1 | 21 | 37 | 21 | 53 | 22 | 10 | 22 | 30 | 22 | 55 | 23 | 32 | 21 | 51 | 22 | 07 | 22 | 49 | 22 | 49 |
| 2 | 22 | 36 | 22 | 55 | 23 | 16 | 23 | 39 | ** | ** | ** | ** | 22 | 57 | 23 | 11 | 23 | 58 | 23 | 54 |

The symbol (**) indicates that the phenomenon will occur on the next day

**MOONSET, 2021**

LOCAL MEAN TIME AND INDIAN STANDARD TIME OF MOONSET (MOON'S UPPER LIMB)

| Date | | FOR THE CENTRAL MERIDIAN OF INDIA ( 82º.5 E ) IN L. M. T. | | | | | | | | | | | | FOR CERTAIN STATIONS IN INDIA IN I.S.T. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Lat. | 0º | | 10º | | 20º | | 30º | | 40º | | 50º | | Kolkata | | Chennai | | Delhi | | Mumbai | |
| | | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m |
| Feb. | 15 | 21 | 08 | 21 | 08 | 21 | 09 | 21 | 09 | 21 | 10 | 21 | 11 | 20 | 45 | 21 | 18 | 21 | 31 | 21 | 49 |
| | 16 | 21 | 49 | 21 | 53 | 21 | 58 | 22 | 03 | 22 | 09 | 22 | 18 | 21 | 35 | 22 | 04 | 22 | 24 | 22 | 37 |
| | 17 | 22 | 30 | 22 | 38 | 22 | 46 | 22 | 56 | 23 | 08 | 23 | 25 | 22 | 24 | 22 | 50 | 23 | 17 | 23 | 26 |
| | 18 | 23 | 13 | 23 | 24 | 23 | 36 | 23 | 50 | ** | ** | ** | ** | 23 | 15 | 23 | 37 | ** | ** | ** | ** |
| | 19 | 23 | 57 | ** | ** | ** | ** | ** | ** | 0 | 07 | 0 | 31 | ** | ** | ** | ** | 0 | 10 | 0 | 15 |
| | 20 | ** | ** | 0 | 11 | 0 | 27 | 0 | 45 | 1 | 07 | 1 | 39 | 0 | 07 | 0 | 25 | 1 | 04 | 1 | 05 |
| | 21 | 0 | 44 | 1 | 01 | 1 | 20 | 1 | 41 | 2 | 07 | 2 | 45 | 1 | 00 | 1 | 16 | 1 | 59 | 1 | 58 |
| | 22 | 1 | 34 | 1 | 53 | 2 | 13 | 2 | 36 | 3 | 06 | 3 | 49 | 1 | 54 | 2 | 08 | 2 | 55 | 2 | 51 |
| | 23 | 2 | 26 | 2 | 46 | 3 | 07 | 3 | 32 | 4 | 02 | 4 | 46 | 2 | 48 | 3 | 02 | 3 | 50 | 3 | 45 |
| | 24 | 3 | 21 | 3 | 40 | 4 | 00 | 4 | 24 | 4 | 54 | 5 | 36 | 3 | 42 | 3 | 55 | 4 | 42 | 4 | 38 |
| | 25 | 4 | 16 | 4 | 33 | 4 | 52 | 5 | 13 | 5 | 40 | 6 | 17 | 4 | 32 | 4 | 48 | 5 | 32 | 5 | 30 |
| | 26 | 5 | 10 | 5 | 25 | 5 | 40 | 5 | 58 | 6 | 19 | 6 | 49 | 5 | 20 | 5 | 39 | 6 | 17 | 6 | 18 |
| | 27 | 6 | 03 | 6 | 14 | 6 | 25 | 6 | 38 | 6 | 54 | 7 | 16 | 6 | 05 | 6 | 27 | 6 | 58 | 7 | 04 |
| | 28 | 6 | 55 | 7 | 02 | 7 | 09 | 7 | 17 | 7 | 26 | 7 | 39 | 6 | 46 | 7 | 13 | 7 | 37 | 7 | 48 |
| Mar. | 1 | 7 | 46 | 7 | 48 | 7 | 50 | 7 | 53 | 7 | 55 | 7 | 59 | 7 | 27 | 7 | 58 | 8 | 13 | 8 | 29 |
| | 2 | 8 | 36 | 8 | 34 | 8 | 31 | 8 | 28 | 8 | 24 | 8 | 18 | 8 | 06 | 8 | 42 | 8 | 50 | 9 | 11 |
| | 3 | 9 | 28 | 9 | 21 | 9 | 13 | 9 | 04 | 8 | 53 | 8 | 39 | 8 | 47 | 9 | 28 | 9 | 27 | 9 | 54 |
| | 4 | 10 | 21 | 10 | 09 | 9 | 57 | 9 | 43 | 9 | 26 | 9 | 02 | 9 | 30 | 10 | 15 | 10 | 07 | 10 | 38 |
| | 5 | 11 | 16 | 11 | 01 | 10 | 44 | 10 | 26 | 10 | 03 | 9 | 31 | 10 | 16 | 11 | 05 | 10 | 50 | 11 | 26 |
| | 6 | 12 | 13 | 11 | 55 | 11 | 36 | 11 | 14 | 10 | 46 | 10 | 06 | 11 | 06 | 11 | 59 | 11 | 39 | 12 | 18 |
| | 7 | 13 | 12 | 12 | 52 | 12 | 31 | 12 | 07 | 11 | 36 | 10 | 52 | 12 | 01 | 12 | 55 | 12 | 32 | 13 | 14 |
| | 8 | 14 | 10 | 13 | 51 | 13 | 30 | 13 | 05 | 12 | 34 | 11 | 49 | 12 | 59 | 13 | 54 | 13 | 31 | 14 | 12 |
| | 9 | 15 | 07 | 14 | 48 | 14 | 29 | 14 | 06 | 13 | 37 | 12 | 56 | 13 | 59 | 14 | 52 | 14 | 31 | 15 | 11 |
| | 10 | 16 | 00 | 15 | 45 | 15 | 28 | 15 | 08 | 14 | 43 | 14 | 08 | 14 | 59 | 15 | 49 | 15 | 33 | 16 | 09 |
| | 11 | 16 | 50 | 16 | 38 | 16 | 24 | 16 | 09 | 15 | 50 | 15 | 23 | 15 | 56 | 16 | 43 | 16 | 33 | 17 | 06 |
| | 12 | 17 | 37 | 17 | 28 | 17 | 19 | 17 | 08 | 16 | 54 | 16 | 35 | 16 | 52 | 17 | 35 | 17 | 32 | 18 | 00 |
| | 13 | 18 | 21 | 18 | 16 | 18 | 11 | 18 | 05 | 17 | 57 | 17 | 47 | 17 | 45 | 18 | 24 | 18 | 27 | 18 | 51 |
| | 14 | 19 | 03 | 19 | 02 | 19 | 01 | 18 | 60 | 18 | 58 | 18 | 56 | 18 | 36 | 19 | 11 | 19 | 22 | 19 | 41 |
| | 15 | 19 | 45 | 19 | 48 | 19 | 51 | 19 | 54 | 19 | 58 | 20 | 04 | 19 | 27 | 19 | 58 | 20 | 15 | 20 | 30 |
| | 16 | 20 | 26 | 20 | 32 | 20 | 39 | 20 | 47 | 20 | 57 | 21 | 11 | 20 | 17 | 20 | 44 | 21 | 08 | 21 | 19 |
| | 17 | 21 | 08 | 21 | 18 | 21 | 29 | 21 | 42 | 21 | 57 | 22 | 18 | 21 | 08 | 21 | 31 | 22 | 01 | 22 | 07 |
| | 18 | 21 | 52 | 22 | 05 | 22 | 19 | 22 | 36 | 22 | 57 | 23 | 26 | 21 | 59 | 22 | 18 | 22 | 55 | 22 | 58 |
| | 19 | 22 | 37 | 22 | 53 | 23 | 11 | 23 | 31 | 23 | 56 | ** | ** | 22 | 51 | 23 | 08 | 23 | 50 | 23 | 49 |
| | 20 | 23 | 25 | 23 | 44 | ** | ** | ** | ** | ** | ** | 0 | 32 | 23 | 45 | 23 | 59 | ** | ** | ** | ** |
| | 21 | ** | ** | ** | ** | 0 | 03 | 0 | 26 | 0 | 55 | 1 | 37 | ** | ** | ** | ** | 0 | 45 | 0 | 41 |
| | 22 | 0 | 16 | 0 | 35 | 0 | 56 | 1 | 21 | 1 | 52 | 2 | 36 | 0 | 38 | 0 | 51 | 1 | 39 | 1 | 35 |
| | 23 | 1 | 08 | 1 | 28 | 1 | 49 | 2 | 13 | 2 | 44 | 3 | 29 | 1 | 31 | 1 | 44 | 2 | 32 | 2 | 27 |
| | 24 | 2 | 02 | 2 | 20 | 2 | 40 | 3 | 03 | 3 | 32 | 4 | 12 | 2 | 21 | 2 | 36 | 3 | 22 | 3 | 18 |
| | 25 | 2 | 56 | 3 | 12 | 3 | 29 | 3 | 49 | 4 | 13 | 4 | 47 | 3 | 10 | 3 | 27 | 4 | 08 | 4 | 07 |
| | 26 | 3 | 49 | 4 | 02 | 4 | 15 | 4 | 31 | 4 | 50 | 5 | 16 | 3 | 55 | 4 | 15 | 4 | 50 | 4 | 54 |
| | 27 | 4 | 41 | 4 | 50 | 4 | 59 | 5 | 10 | 5 | 23 | 5 | 40 | 4 | 38 | 5 | 02 | 5 | 30 | 5 | 38 |
| | 28 | 5 | 33 | 5 | 37 | 5 | 42 | 5 | 47 | 5 | 53 | 6 | 01 | 5 | 19 | 5 | 48 | 6 | 07 | 6 | 21 |
| | 29 | 6 | 24 | 6 | 23 | 6 | 23 | 6 | 22 | 6 | 21 | 6 | 20 | 5 | 59 | 6 | 33 | 6 | 44 | 7 | 03 |
| | 30 | 7 | 17 | 7 | 11 | 7 | 06 | 6 | 59 | 6 | 51 | 6 | 41 | 6 | 40 | 7 | 19 | 7 | 22 | 7 | 46 |
| | 31 | 8 | 10 | 8 | 01 | 7 | 50 | 7 | 38 | 7 | 23 | 7 | 03 | 7 | 23 | 8 | 07 | 8 | 01 | 8 | 31 |
| Apr. | 1 | 9 | 07 | 8 | 53 | 8 | 37 | 8 | 20 | 7 | 59 | 7 | 30 | 8 | 09 | 8 | 58 | 8 | 45 | 9 | 19 |
| | 2 | 10 | 05 | 9 | 48 | 9 | 30 | 9 | 08 | 8 | 41 | 8 | 03 | 9 | 00 | 9 | 52 | 9 | 33 | 10 | 11 |

The symbol (**) indicates that the phenomenon will occur on the next day

**MOONRISE, 2021**
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONRISE (MOON'S UPPER LIMB)

| FOR THE CENTRAL MERIDIAN OF INDIA ( 82º.5 E ) IN L. M. T. | | | | | | | | | | | | | FOR CERTAIN STATIONS IN INDIA IN I.S.T. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lat. / Date | 0º | | 10º | | 20º | | 30º | | 40º | | 50º | | Kolkata | | Chennai | | Delhi | | Mumbai | |
| | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m |
| Apr. 2 | 22 | 36 | 22 | 55 | 23 | 16 | 23 | 39 | ** | ** | ** | ** | 22 | 57 | 23 | 11 | 23 | 58 | 23 | 54 |
| 3 | 23 | 37 | 23 | 57 | ** | ** | ** | ** | 0 | 08 | 0 | 51 | 24 | 00 | ** | ** | ** | ** | ** | ** |
| 4 | ** | ** | ** | ** | 0 | 18 | 0 | 43 | 1 | 15 | 2 | 01 | ** | ** | 0 | 12 | 1 | 01 | 0 | 56 |
| 5 | 0 | 36 | 0 | 55 | 1 | 17 | 1 | 41 | 2 | 12 | 2 | 56 | 0 | 58 | 1 | 11 | 1 | 59 | 1 | 54 |
| 6 | 1 | 32 | 1 | 50 | 2 | 09 | 2 | 31 | 2 | 59 | 3 | 39 | 1 | 50 | 2 | 05 | 2 | 50 | 2 | 47 |
| 7 | 2 | 24 | 2 | 39 | 2 | 56 | 3 | 15 | 3 | 38 | 4 | 10 | 2 | 36 | 2 | 54 | 3 | 34 | 3 | 34 |
| 8 | 3 | 13 | 3 | 25 | 3 | 38 | 3 | 52 | 4 | 10 | 4 | 34 | 3 | 17 | 3 | 38 | 4 | 11 | 4 | 16 |
| 9 | 3 | 59 | 4 | 07 | 4 | 15 | 4 | 25 | 4 | 37 | 4 | 54 | 3 | 54 | 4 | 18 | 4 | 45 | 4 | 54 |
| 10 | 4 | 41 | 4 | 46 | 4 | 50 | 4 | 56 | 5 | 02 | 5 | 11 | 4 | 28 | 4 | 56 | 5 | 17 | 5 | 30 |
| 11 | 5 | 23 | 5 | 24 | 5 | 24 | 5 | 25 | 5 | 26 | 5 | 27 | 5 | 00 | 5 | 33 | 5 | 46 | 6 | 03 |
| 12 | 6 | 04 | 6 | 01 | 5 | 57 | 5 | 53 | 5 | 48 | 5 | 42 | 5 | 32 | 6 | 09 | 6 | 15 | 6 | 37 |
| 13 | 6 | 45 | 6 | 38 | 6 | 30 | 6 | 22 | 6 | 11 | 5 | 57 | 6 | 04 | 6 | 45 | 6 | 44 | 7 | 11 |
| 14 | 7 | 27 | 7 | 17 | 7 | 05 | 6 | 52 | 6 | 36 | 6 | 15 | 6 | 38 | 7 | 23 | 7 | 16 | 7 | 46 |
| 15 | 8 | 11 | 7 | 57 | 7 | 43 | 7 | 26 | 7 | 05 | 6 | 35 | 7 | 14 | 8 | 02 | 7 | 50 | 8 | 23 |
| 16 | 8 | 57 | 8 | 40 | 8 | 22 | 8 | 02 | 7 | 37 | 7 | 01 | 7 | 54 | 8 | 44 | 8 | 27 | 9 | 04 |
| 17 | 9 | 46 | 9 | 27 | 9 | 07 | 8 | 43 | 8 | 14 | 7 | 33 | 8 | 37 | 9 | 30 | 9 | 09 | 9 | 49 |
| 18 | 10 | 36 | 10 | 16 | 9 | 55 | 9 | 30 | 8 | 59 | 8 | 14 | 9 | 25 | 10 | 19 | 9 | 56 | 10 | 37 |
| 19 | 11 | 28 | 11 | 08 | 10 | 46 | 10 | 22 | 9 | 51 | 9 | 05 | 10 | 16 | 11 | 11 | 10 | 47 | 11 | 29 |
| 20 | 12 | 20 | 12 | 01 | 11 | 42 | 11 | 19 | 10 | 49 | 10 | 07 | 11 | 12 | 12 | 05 | 11 | 44 | 12 | 23 |
| 21 | 13 | 12 | 12 | 56 | 12 | 38 | 12 | 18 | 11 | 53 | 11 | 18 | 12 | 09 | 13 | 00 | 12 | 43 | 13 | 21 |
| 22 | 14 | 04 | 13 | 51 | 13 | 37 | 13 | 21 | 13 | 01 | 12 | 33 | 13 | 09 | 13 | 56 | 13 | 46 | 14 | 18 |
| 23 | 14 | 54 | 14 | 45 | 14 | 36 | 14 | 25 | 14 | 11 | 13 | 53 | 14 | 09 | 14 | 52 | 14 | 49 | 15 | 17 |
| 24 | 15 | 45 | 15 | 41 | 15 | 36 | 15 | 31 | 15 | 24 | 15 | 15 | 15 | 10 | 15 | 49 | 15 | 53 | 16 | 16 |
| 25 | 16 | 36 | 16 | 36 | 16 | 36 | 16 | 37 | 16 | 38 | 16 | 38 | 16 | 12 | 16 | 45 | 16 | 59 | 17 | 17 |
| 26 | 17 | 28 | 17 | 34 | 17 | 39 | 17 | 46 | 17 | 54 | 18 | 05 | 17 | 16 | 17 | 45 | 18 | 07 | 18 | 19 |
| 27 | 18 | 23 | 18 | 33 | 18 | 44 | 18 | 56 | 19 | 12 | 19 | 34 | 18 | 22 | 18 | 45 | 19 | 17 | 19 | 23 |
| 28 | 19 | 21 | 19 | 35 | 19 | 51 | 20 | 08 | 20 | 31 | 21 | 03 | 19 | 31 | 19 | 49 | 20 | 28 | 20 | 29 |
| 29 | 20 | 21 | 20 | 39 | 20 | 59 | 21 | 21 | 21 | 49 | 22 | 30 | 20 | 39 | 20 | 55 | 21 | 40 | 21 | 37 |
| 30 | 21 | 25 | 21 | 44 | 22 | 05 | 22 | 30 | 23 | 02 | 23 | 48 | 21 | 47 | 22 | 00 | 22 | 48 | 22 | 43 |
| May 1 | 22 | 26 | 22 | 46 | 23 | 08 | 23 | 33 | ** | ** | ** | ** | 22 | 50 | 23 | 02 | 23 | 52 | 23 | 46 |
| 2 | 23 | 26 | 23 | 45 | ** | ** | ** | ** | 0 | 05 | 0 | 51 | 23 | 46 | 24 | 00 | ** | ** | ** | ** |
| 3 | ** | ** | ** | ** | 0 | 05 | 0 | 28 | 0 | 57 | 1 | 39 | ** | ** | ** | ** | 0 | 46 | 0 | 42 |
| 4 | 0 | 20 | 0 | 37 | 0 | 54 | 1 | 15 | 1 | 40 | 2 | 14 | 0 | 35 | 0 | 51 | 1 | 34 | 1 | 33 |
| 5 | 1 | 11 | 1 | 25 | 1 | 39 | 1 | 54 | 2 | 14 | 2 | 41 | 1 | 18 | 1 | 38 | 2 | 13 | 2 | 16 |
| 6 | 1 | 58 | 2 | 07 | 2 | 17 | 2 | 29 | 2 | 43 | 3 | 02 | 1 | 56 | 2 | 19 | 2 | 49 | 2 | 56 |
| 7 | 2 | 41 | 2 | 47 | 2 | 53 | 2 | 60 | 3 | 08 | 3 | 19 | 2 | 30 | 2 | 58 | 3 | 20 | 3 | 32 |
| 8 | 3 | 23 | 3 | 25 | 3 | 27 | 3 | 29 | 3 | 31 | 3 | 35 | 3 | 03 | 3 | 35 | 3 | 50 | 4 | 06 |
| 9 | 4 | 04 | 4 | 01 | 3 | 59 | 3 | 57 | 3 | 54 | 3 | 50 | 3 | 35 | 4 | 10 | 4 | 18 | 4 | 39 |
| 10 | 4 | 44 | 4 | 38 | 4 | 32 | 4 | 25 | 4 | 16 | 4 | 05 | 4 | 06 | 4 | 45 | 4 | 47 | 5 | 12 |
| 11 | 5 | 26 | 5 | 16 | 5 | 06 | 4 | 55 | 4 | 40 | 4 | 21 | 4 | 39 | 5 | 23 | 5 | 18 | 5 | 47 |
| 12 | 6 | 09 | 5 | 56 | 5 | 42 | 5 | 27 | 5 | 07 | 4 | 41 | 5 | 15 | 6 | 01 | 5 | 51 | 6 | 23 |
| 13 | 6 | 54 | 6 | 38 | 6 | 21 | 6 | 02 | 5 | 38 | 5 | 04 | 5 | 53 | 6 | 42 | 6 | 26 | 7 | 03 |
| 14 | 7 | 42 | 7 | 24 | 7 | 04 | 6 | 41 | 6 | 13 | 5 | 34 | 6 | 34 | 7 | 27 | 7 | 07 | 7 | 46 |
| 15 | 8 | 31 | 8 | 12 | 7 | 51 | 7 | 27 | 6 | 56 | 6 | 11 | 7 | 21 | 8 | 15 | 7 | 52 | 8 | 33 |
| 16 | 9 | 23 | 9 | 03 | 8 | 41 | 8 | 16 | 7 | 45 | 6 | 59 | 8 | 11 | 9 | 06 | 8 | 42 | 9 | 24 |
| 17 | 10 | 14 | 9 | 55 | 9 | 35 | 9 | 11 | 8 | 40 | 7 | 57 | 9 | 05 | 9 | 59 | 9 | 36 | 10 | 17 |
| 18 | 11 | 06 | 10 | 49 | 10 | 30 | 10 | 09 | 9 | 42 | 9 | 03 | 10 | 01 | 10 | 52 | 10 | 34 | 11 | 12 |

The symbol (**) indicates that the phenomenon will occur on the next day

**MOONSET, 2021**
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONSET (MOON'S UPPER LIMB)

| | FOR THE CENTRAL MERIDIAN OF INDIA ( 82º.5 E ) IN L. M. T. | | | | | | | | | | | | FOR CERTAIN STATIONS IN INDIA IN I.S.T. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date \ Lat. | 0º | | 10º | | 20º | | 30º | | 40º | | 50º | | Kolkata | | Chennai | | Delhi | | Mumbai | |
| | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m |
| Apr. 2 | 10 | 05 | 9 | 48 | 9 | 30 | 9 | 08 | 8 | 41 | 8 | 03 | 9 | 00 | 9 | 52 | 9 | 33 | 10 | 11 |
| 3 | 11 | 06 | 10 | 46 | 10 | 25 | 10 | 01 | 9 | 31 | 8 | 46 | 9 | 55 | 10 | 49 | 10 | 26 | 11 | 08 |
| 4 | 12 | 05 | 11 | 46 | 11 | 24 | 10 | 59 | 10 | 27 | 9 | 41 | 10 | 54 | 11 | 49 | 11 | 25 | 12 | 06 |
| 5 | 13 | 03 | 12 | 44 | 12 | 23 | 11 | 60 | 11 | 30 | 10 | 46 | 11 | 54 | 12 | 47 | 12 | 25 | 13 | 06 |
| 6 | 13 | 58 | 13 | 41 | 13 | 23 | 13 | 02 | 12 | 35 | 11 | 58 | 12 | 53 | 13 | 45 | 13 | 27 | 14 | 05 |
| 7 | 14 | 48 | 14 | 34 | 14 | 19 | 14 | 03 | 13 | 42 | 13 | 12 | 13 | 51 | 14 | 39 | 14 | 27 | 15 | 01 |
| 8 | 15 | 35 | 15 | 25 | 15 | 14 | 15 | 02 | 14 | 46 | 14 | 24 | 14 | 47 | 15 | 31 | 15 | 26 | 15 | 55 |
| 9 | 16 | 19 | 16 | 13 | 16 | 06 | 15 | 58 | 15 | 49 | 15 | 36 | 15 | 40 | 16 | 20 | 16 | 21 | 16 | 47 |
| 10 | 17 | 01 | 16 | 59 | 16 | 56 | 16 | 53 | 16 | 50 | 16 | 44 | 16 | 31 | 17 | 08 | 17 | 16 | 17 | 37 |
| 11 | 17 | 43 | 17 | 44 | 17 | 46 | 17 | 47 | 17 | 50 | 17 | 53 | 17 | 22 | 17 | 54 | 18 | 09 | 18 | 25 |
| 12 | 18 | 23 | 18 | 28 | 18 | 34 | 18 | 41 | 18 | 49 | 18 | 60 | 18 | 12 | 18 | 39 | 19 | 02 | 19 | 14 |
| 13 | 19 | 05 | 19 | 14 | 19 | 24 | 19 | 35 | 19 | 48 | 20 | 07 | 19 | 02 | 19 | 26 | 19 | 55 | 20 | 02 |
| 14 | 19 | 48 | 20 | 00 | 20 | 13 | 20 | 29 | 20 | 48 | 21 | 15 | 19 | 53 | 20 | 13 | 20 | 48 | 20 | 52 |
| 15 | 20 | 32 | 20 | 48 | 21 | 05 | 21 | 24 | 21 | 48 | 22 | 22 | 20 | 45 | 21 | 02 | 21 | 43 | 21 | 43 |
| 16 | 21 | 20 | 21 | 38 | 21 | 57 | 22 | 19 | 22 | 47 | 23 | 28 | 21 | 38 | 21 | 53 | 22 | 38 | 22 | 35 |
| 17 | 22 | 09 | 22 | 28 | 22 | 49 | 23 | 14 | 23 | 45 | ** | ** | 22 | 31 | 22 | 44 | 23 | 32 | 23 | 28 |
| 18 | 23 | 00 | 23 | 21 | 23 | 42 | ** | ** | ** | ** | 0 | 29 | 23 | 24 | 23 | 36 | ** | ** | ** | ** |
| 19 | 23 | 53 | ** | ** | ** | ** | 0 | 06 | 0 | 38 | 1 | 24 | ** | ** | ** | ** | 0 | 25 | 0 | 19 |
| 20 | ** | ** | 0 | 12 | 0 | 32 | 0 | 56 | 1 | 27 | 2 | 09 | 0 | 14 | 0 | 27 | 1 | 15 | 1 | 10 |
| 21 | 0 | 45 | 1 | 02 | 1 | 21 | 1 | 43 | 2 | 09 | 2 | 47 | 1 | 02 | 1 | 17 | 2 | 01 | 1 | 59 |
| 22 | 1 | 37 | 1 | 52 | 2 | 07 | 2 | 24 | 2 | 46 | 3 | 17 | 1 | 47 | 2 | 05 | 2 | 44 | 2 | 45 |
| 23 | 2 | 28 | 2 | 39 | 2 | 50 | 3 | 04 | 3 | 20 | 3 | 42 | 2 | 29 | 2 | 52 | 3 | 24 | 3 | 29 |
| 24 | 3 | 19 | 3 | 25 | 3 | 32 | 3 | 40 | 3 | 50 | 4 | 03 | 3 | 10 | 3 | 37 | 4 | 01 | 4 | 11 |
| 25 | 4 | 09 | 4 | 11 | 4 | 13 | 4 | 15 | 4 | 18 | 4 | 22 | 3 | 50 | 4 | 21 | 4 | 37 | 4 | 53 |
| 26 | 5 | 01 | 4 | 58 | 4 | 55 | 4 | 51 | 4 | 47 | 4 | 42 | 4 | 30 | 5 | 06 | 5 | 14 | 5 | 35 |
| 27 | 5 | 54 | 5 | 47 | 5 | 39 | 5 | 29 | 5 | 18 | 5 | 03 | 5 | 12 | 5 | 53 | 5 | 52 | 6 | 19 |
| 28 | 6 | 50 | 6 | 38 | 6 | 25 | 6 | 10 | 5 | 52 | 5 | 27 | 5 | 57 | 6 | 43 | 6 | 34 | 7 | 07 |
| 29 | 7 | 50 | 7 | 34 | 7 | 17 | 6 | 57 | 6 | 32 | 5 | 58 | 6 | 47 | 7 | 38 | 7 | 22 | 7 | 58 |
| 30 | 8 | 52 | 8 | 33 | 8 | 12 | 7 | 49 | 7 | 20 | 6 | 37 | 7 | 43 | 8 | 36 | 8 | 14 | 8 | 55 |
| May 1 | 9 | 54 | 9 | 34 | 9 | 13 | 8 | 47 | 8 | 15 | 7 | 29 | 8 | 42 | 9 | 37 | 9 | 13 | 9 | 55 |
| 2 | 10 | 55 | 10 | 35 | 10 | 14 | 9 | 50 | 9 | 19 | 8 | 33 | 9 | 44 | 10 | 38 | 10 | 15 | 10 | 57 |
| 3 | 11 | 53 | 11 | 35 | 11 | 16 | 10 | 53 | 10 | 25 | 9 | 45 | 10 | 46 | 11 | 39 | 11 | 19 | 11 | 58 |
| 4 | 12 | 45 | 12 | 30 | 12 | 14 | 11 | 56 | 11 | 33 | 10 | 60 | 11 | 46 | 12 | 35 | 12 | 21 | 12 | 56 |
| 5 | 13 | 34 | 13 | 23 | 13 | 10 | 12 | 56 | 12 | 38 | 12 | 14 | 12 | 43 | 13 | 28 | 13 | 20 | 13 | 52 |
| 6 | 14 | 19 | 14 | 11 | 14 | 03 | 13 | 54 | 13 | 42 | 13 | 26 | 13 | 37 | 14 | 18 | 14 | 17 | 14 | 44 |
| 7 | 15 | 01 | 14 | 58 | 14 | 54 | 14 | 49 | 14 | 43 | 14 | 35 | 14 | 28 | 15 | 06 | 15 | 12 | 15 | 34 |
| 8 | 15 | 42 | 15 | 43 | 15 | 43 | 15 | 43 | 15 | 43 | 15 | 44 | 15 | 19 | 15 | 52 | 16 | 05 | 16 | 22 |
| 9 | 16 | 22 | 16 | 27 | 16 | 31 | 16 | 36 | 16 | 42 | 16 | 50 | 16 | 08 | 16 | 37 | 16 | 57 | 17 | 11 |
| 10 | 17 | 04 | 17 | 12 | 17 | 20 | 17 | 30 | 17 | 41 | 17 | 58 | 16 | 58 | 17 | 23 | 17 | 50 | 17 | 59 |
| 11 | 17 | 46 | 17 | 57 | 18 | 09 | 18 | 23 | 18 | 41 | 19 | 05 | 17 | 49 | 18 | 10 | 18 | 43 | 18 | 48 |
| 12 | 18 | 30 | 18 | 45 | 19 | 00 | 19 | 18 | 19 | 41 | 20 | 12 | 18 | 40 | 18 | 59 | 19 | 38 | 19 | 39 |
| 13 | 19 | 17 | 19 | 34 | 19 | 52 | 20 | 13 | 20 | 40 | 21 | 19 | 19 | 33 | 19 | 49 | 20 | 32 | 20 | 30 |
| 14 | 20 | 05 | 20 | 24 | 20 | 45 | 21 | 09 | 21 | 39 | 22 | 22 | 20 | 26 | 20 | 40 | 21 | 27 | 21 | 23 |
| 15 | 20 | 56 | 21 | 16 | 21 | 38 | 22 | 02 | 22 | 34 | 23 | 20 | 21 | 19 | 21 | 32 | 22 | 20 | 22 | 15 |
| 16 | 21 | 48 | 22 | 07 | 22 | 28 | 22 | 53 | 23 | 24 | ** | ** | 22 | 10 | 22 | 23 | 23 | 11 | 23 | 06 |
| 17 | 22 | 39 | 22 | 57 | 23 | 17 | 23 | 40 | ** | ** | 0 | 08 | 22 | 58 | 23 | 13 | 23 | 58 | 23 | 55 |
| 18 | 23 | 30 | 23 | 46 | ** | ** | ** | ** | 0 | 08 | 0 | 48 | 23 | 44 | ** | ** | ** | ** | ** | ** |

The symbol (**) indicates that the phenomenon will occur on the next day

**MOONRISE, 2021**

LOCAL MEAN TIME AND INDIAN STANDARD TIME OF MOONRISE (MOON'S UPPER LIMB)

| | | FOR THE CENTRAL MERIDIAN OF INDIA ( 82º.5 E ) IN L. M. T. | | | | | | | | | | | | FOR CERTAIN STATIONS IN INDIA IN I.S.T. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Lat. | 0º | | 10º | | 20º | | 30º | | 40º | | 50º | | Kolkata | | Chennai | | Delhi | | Mumbai | |
| | | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m |
| May | 18 | 11 | 06 | 10 | 49 | 10 | 30 | 10 | 09 | 9 | 42 | 9 | 03 | 10 | 01 | 10 | 52 | 10 | 34 | 11 | 12 |
| | 19 | 11 | 56 | 11 | 42 | 11 | 27 | 11 | 09 | 10 | 47 | 10 | 15 | 10 | 58 | 11 | 47 | 11 | 34 | 12 | 08 |
| | 20 | 12 | 46 | 12 | 35 | 12 | 23 | 12 | 10 | 11 | 54 | 11 | 32 | 11 | 56 | 12 | 41 | 12 | 34 | 13 | 05 |
| | 21 | 13 | 35 | 13 | 28 | 13 | 21 | 13 | 13 | 13 | 03 | 12 | 50 | 12 | 55 | 13 | 35 | 13 | 36 | 14 | 02 |
| | 22 | 14 | 23 | 14 | 21 | 14 | 19 | 14 | 17 | 14 | 14 | 14 | 10 | 13 | 54 | 14 | 30 | 14 | 39 | 15 | 00 |
| | 23 | 15 | 13 | 15 | 16 | 15 | 19 | 15 | 23 | 15 | 27 | 15 | 33 | 14 | 55 | 15 | 27 | 15 | 44 | 15 | 59 |
| | 24 | 16 | 06 | 16 | 13 | 16 | 21 | 16 | 30 | 16 | 42 | 16 | 58 | 15 | 59 | 16 | 25 | 16 | 51 | 17 | 01 |
| | 25 | 17 | 02 | 17 | 14 | 17 | 27 | 17 | 42 | 18 | 01 | 18 | 27 | 17 | 06 | 17 | 27 | 18 | 02 | 18 | 06 |
| | 26 | 18 | 01 | 18 | 17 | 18 | 35 | 18 | 55 | 19 | 21 | 19 | 57 | 18 | 15 | 18 | 32 | 19 | 14 | 19 | 13 |
| | 27 | 19 | 04 | 19 | 23 | 19 | 44 | 20 | 07 | 20 | 38 | 21 | 22 | 19 | 25 | 19 | 39 | 20 | 26 | 20 | 22 |
| | 28 | 20 | 08 | 20 | 29 | 20 | 51 | 21 | 16 | 21 | 48 | 22 | 35 | 20 | 32 | 20 | 45 | 21 | 34 | 21 | 29 |
| | 29 | 21 | 12 | 21 | 31 | 21 | 52 | 22 | 16 | 22 | 47 | 23 | 32 | 21 | 34 | 21 | 47 | 22 | 35 | 22 | 30 |
| | 30 | 22 | 11 | 22 | 28 | 22 | 47 | 23 | 09 | 23 | 36 | ** | ** | 22 | 28 | 22 | 43 | 23 | 27 | 23 | 25 |
| | 31 | 23 | 05 | 23 | 19 | 23 | 35 | 23 | 52 | ** | ** | 0 | 14 | 23 | 15 | 23 | 33 | ** | ** | ** | ** |
| June | 1 | 23 | 54 | ** | ** | ** | ** | ** | ** | 0 | 14 | 0 | 44 | 23 | 56 | ** | ** | 0 | 11 | 0 | 13 |
| | 2 | ** | ** | 0 | 05 | 0 | 16 | 0 | 29 | 0 | 46 | 1 | 08 | ** | ** | 0 | 17 | 0 | 49 | 0 | 55 |
| | 3 | 0 | 39 | 0 | 46 | 0 | 54 | 1 | 02 | 1 | 13 | 1 | 27 | 0 | 32 | 0 | 58 | 1 | 23 | 1 | 33 |
| | 4 | 1 | 22 | 1 | 25 | 1 | 29 | 1 | 32 | 1 | 37 | 1 | 43 | 1 | 05 | 1 | 35 | 1 | 53 | 2 | 07 |
| | 5 | 2 | 03 | 2 | 02 | 2 | 01 | 2 | 00 | 1 | 59 | 1 | 58 | 1 | 37 | 2 | 11 | 2 | 22 | 2 | 41 |
| | 6 | 2 | 43 | 2 | 39 | 2 | 34 | 2 | 28 | 2 | 21 | 2 | 12 | 2 | 09 | 2 | 46 | 2 | 51 | 3 | 14 |
| | 7 | 3 | 25 | 3 | 16 | 3 | 07 | 2 | 57 | 2 | 45 | 2 | 28 | 2 | 41 | 3 | 23 | 3 | 21 | 3 | 48 |
| | 8 | 4 | 07 | 3 | 55 | 3 | 43 | 3 | 29 | 3 | 11 | 2 | 47 | 3 | 15 | 4 | 01 | 3 | 52 | 4 | 23 |
| | 9 | 4 | 52 | 4 | 36 | 4 | 20 | 4 | 02 | 3 | 40 | 3 | 09 | 3 | 52 | 4 | 41 | 4 | 27 | 5 | 02 |
| | 10 | 5 | 39 | 5 | 21 | 5 | 02 | 4 | 41 | 4 | 14 | 3 | 36 | 4 | 33 | 5 | 25 | 5 | 06 | 5 | 44 |
| | 11 | 6 | 28 | 6 | 08 | 5 | 48 | 5 | 24 | 4 | 54 | 4 | 11 | 5 | 18 | 6 | 12 | 5 | 49 | 6 | 30 |
| | 12 | 7 | 19 | 6 | 59 | 6 | 37 | 6 | 12 | 5 | 41 | 4 | 55 | 6 | 07 | 7 | 02 | 6 | 38 | 7 | 20 |
| | 13 | 8 | 11 | 7 | 52 | 7 | 31 | 7 | 06 | 6 | 35 | 5 | 50 | 7 | 00 | 7 | 55 | 7 | 32 | 8 | 13 |
| | 14 | 9 | 03 | 8 | 45 | 8 | 25 | 8 | 03 | 7 | 35 | 6 | 54 | 7 | 56 | 8 | 48 | 8 | 28 | 9 | 08 |
| | 15 | 9 | 53 | 9 | 38 | 9 | 22 | 9 | 03 | 8 | 38 | 8 | 05 | 8 | 53 | 9 | 43 | 9 | 27 | 10 | 03 |
| | 16 | 10 | 42 | 10 | 30 | 10 | 17 | 10 | 03 | 9 | 45 | 9 | 19 | 9 | 50 | 10 | 36 | 10 | 27 | 10 | 59 |
| | 17 | 11 | 30 | 11 | 22 | 11 | 14 | 11 | 04 | 10 | 51 | 10 | 35 | 10 | 47 | 11 | 29 | 11 | 27 | 11 | 55 |
| | 18 | 12 | 17 | 12 | 13 | 12 | 09 | 12 | 05 | 11 | 59 | 11 | 52 | 11 | 44 | 12 | 21 | 12 | 27 | 12 | 50 |
| | 19 | 13 | 05 | 13 | 06 | 13 | 07 | 13 | 08 | 13 | 09 | 13 | 11 | 12 | 42 | 13 | 15 | 13 | 30 | 13 | 47 |
| | 20 | 13 | 54 | 13 | 60 | 14 | 05 | 14 | 12 | 14 | 20 | 14 | 32 | 13 | 43 | 14 | 10 | 14 | 33 | 14 | 45 |
| | 21 | 14 | 46 | 14 | 56 | 15 | 07 | 15 | 20 | 15 | 35 | 15 | 57 | 14 | 46 | 15 | 09 | 15 | 40 | 15 | 47 |
| | 22 | 15 | 43 | 15 | 57 | 16 | 12 | 16 | 30 | 16 | 52 | 17 | 24 | 15 | 52 | 16 | 11 | 16 | 50 | 16 | 51 |
| | 23 | 16 | 43 | 17 | 01 | 17 | 20 | 17 | 43 | 18 | 10 | 18 | 51 | 17 | 01 | 17 | 16 | 18 | 01 | 17 | 59 |
| | 24 | 17 | 47 | 18 | 07 | 18 | 28 | 18 | 53 | 19 | 25 | 20 | 11 | 18 | 10 | 18 | 22 | 19 | 12 | 19 | 06 |
| | 25 | 18 | 52 | 19 | 12 | 19 | 34 | 19 | 59 | 20 | 30 | 21 | 17 | 19 | 15 | 19 | 28 | 20 | 17 | 20 | 11 |
| | 26 | 19 | 54 | 20 | 13 | 20 | 33 | 20 | 56 | 21 | 25 | 22 | 07 | 20 | 14 | 20 | 28 | 21 | 15 | 21 | 11 |
| | 27 | 20 | 52 | 21 | 08 | 21 | 25 | 21 | 45 | 22 | 09 | 22 | 43 | 21 | 06 | 21 | 23 | 22 | 03 | 22 | 03 |
| | 28 | 21 | 45 | 21 | 57 | 22 | 11 | 22 | 26 | 22 | 44 | 23 | 10 | 21 | 50 | 22 | 10 | 22 | 04 | 22 | 49 |
| | 29 | 22 | 33 | 22 | 42 | 22 | 51 | 23 | 01 | 23 | 14 | 23 | 31 | 22 | 29 | 22 | 54 | 23 | 21 | 23 | 30 |
| | 30 | 23 | 18 | 23 | 23 | 23 | 27 | 23 | 33 | 23 | 40 | 23 | 49 | 23 | 05 | 23 | 33 | 23 | 54 | ** | ** |
| July | 1 | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | 23 | 38 | ** | ** | ** | ** | 0 | 06 |
| | 2 | 0 | 00 | 0 | 01 | 0 | 01 | 0 | 02 | 0 | 03 | 0 | 04 | ** | ** | 0 | 10 | 0 | 23 | 0 | 41 |
| | 3 | 0 | 41 | 0 | 38 | 0 | 34 | 0 | 30 | 0 | 25 | 0 | 19 | 0 | 09 | 0 | 46 | 0 | 52 | 1 | 14 |

The symbol (**) indicates that the phenomenon will occur on the next day

**MOONSET, 2021**
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONSET (MOON'S UPPER LIMB)

| | | FOR THE CENTRAL MERIDIAN OF INDIA ( 82º.5 E ) IN L. M. T. | | | | | | | | | | | | FOR CERTAIN STATIONS IN INDIA IN I.S.T. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Lat. | 0º | | 10º | | 20º | | 30º | | 40º | | 50º | | Kolkata | | Chennai | | Delhi | | Mumbai | |
| | | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m |
| May | 18 | 23 | 30 | 23 | 46 | ** | ** | ** | ** | 0 | 08 | 0 | 48 | 23 | 44 | ** | ** | ** | ** | ** | ** |
| | 19 | ** | ** | ** | ** | 0 | 03 | 0 | 22 | 0 | 46 | 1 | 20 | ** | ** | 0 | 00 | 0 | 41 | 0 | 41 |
| | 20 | 0 | 20 | 0 | 32 | 0 | 46 | 1 | 01 | 1 | 20 | 1 | 45 | 0 | 25 | 0 | 46 | 1 | 21 | 1 | 24 |
| | 21 | 1 | 09 | 1 | 18 | 1 | 27 | 1 | 37 | 1 | 50 | 2 | 07 | 1 | 05 | 1 | 30 | 1 | 57 | 2 | 05 |
| | 22 | 1 | 58 | 2 | 02 | 2 | 06 | 2 | 11 | 2 | 17 | 2 | 26 | 1 | 44 | 2 | 12 | 2 | 32 | 2 | 46 |
| | 23 | 2 | 47 | 2 | 47 | 2 | 46 | 2 | 46 | 2 | 45 | 2 | 44 | 2 | 22 | 2 | 56 | 3 | 08 | 3 | 26 |
| | 24 | 3 | 38 | 3 | 33 | 3 | 28 | 3 | 22 | 3 | 14 | 3 | 04 | 3 | 02 | 3 | 41 | 3 | 44 | 4 | 08 |
| | 25 | 4 | 32 | 4 | 22 | 4 | 12 | 3 | 60 | 3 | 45 | 3 | 26 | 3 | 45 | 4 | 28 | 4 | 23 | 4 | 53 |
| | 26 | 5 | 30 | 5 | 16 | 5 | 00 | 4 | 43 | 4 | 22 | 3 | 52 | 4 | 32 | 5 | 20 | 5 | 07 | 5 | 42 |
| | 27 | 6 | 31 | 6 | 13 | 5 | 55 | 5 | 33 | 5 | 06 | 4 | 27 | 5 | 25 | 6 | 17 | 5 | 58 | 6 | 37 |
| | 28 | 7 | 35 | 7 | 15 | 6 | 54 | 6 | 29 | 5 | 58 | 5 | 13 | 6 | 24 | 7 | 19 | 6 | 55 | 7 | 37 |
| | 29 | 8 | 39 | 8 | 19 | 7 | 57 | 7 | 32 | 6 | 60 | 6 | 13 | 7 | 27 | 8 | 22 | 7 | 58 | 8 | 40 |
| | 30 | 9 | 41 | 9 | 22 | 9 | 01 | 8 | 38 | 8 | 08 | 7 | 25 | 8 | 31 | 9 | 25 | 9 | 03 | 9 | 44 |
| | 31 | 10 | 37 | 10 | 21 | 10 | 04 | 9 | 44 | 9 | 18 | 8 | 41 | 9 | 35 | 10 | 25 | 10 | 08 | 10 | 46 |
| June | 1 | 11 | 29 | 11 | 16 | 11 | 02 | 10 | 46 | 10 | 26 | 9 | 59 | 10 | 34 | 11 | 22 | 11 | 11 | 11 | 44 |
| | 2 | 12 | 16 | 12 | 07 | 11 | 58 | 11 | 47 | 11 | 33 | 11 | 14 | 11 | 31 | 12 | 13 | 12 | 10 | 12 | 38 |
| | 3 | 12 | 60 | 12 | 55 | 12 | 49 | 12 | 43 | 12 | 35 | 12 | 25 | 12 | 24 | 13 | 03 | 13 | 06 | 13 | 30 |
| | 4 | 13 | 42 | 13 | 41 | 13 | 40 | 13 | 38 | 13 | 36 | 13 | 34 | 13 | 15 | 13 | 50 | 14 | 00 | 14 | 19 |
| | 5 | 14 | 22 | 14 | 25 | 14 | 28 | 14 | 31 | 14 | 35 | 14 | 41 | 14 | 05 | 14 | 35 | 14 | 53 | 15 | 08 |
| | 6 | 15 | 03 | 15 | 10 | 15 | 17 | 15 | 25 | 15 | 35 | 15 | 48 | 14 | 54 | 15 | 21 | 15 | 45 | 15 | 56 |
| | 7 | 15 | 45 | 15 | 55 | 16 | 06 | 16 | 18 | 16 | 34 | 16 | 55 | 15 | 45 | 16 | 07 | 16 | 38 | 16 | 44 |
| | 8 | 16 | 28 | 16 | 41 | 16 | 56 | 17 | 13 | 17 | 34 | 18 | 03 | 16 | 36 | 16 | 55 | 17 | 32 | 17 | 35 |
| | 9 | 17 | 14 | 17 | 30 | 17 | 48 | 18 | 08 | 18 | 34 | 19 | 10 | 17 | 29 | 17 | 45 | 18 | 27 | 18 | 26 |
| | 10 | 18 | 02 | 18 | 20 | 18 | 40 | 19 | 04 | 19 | 33 | 20 | 15 | 18 | 21 | 18 | 35 | 19 | 22 | 19 | 19 |
| | 11 | 18 | 52 | 19 | 12 | 19 | 34 | 19 | 58 | 20 | 29 | 21 | 15 | 19 | 15 | 19 | 28 | 20 | 16 | 20 | 11 |
| | 12 | 19 | 44 | 20 | 04 | 20 | 25 | 20 | 50 | 21 | 22 | 22 | 07 | 20 | 07 | 20 | 19 | 21 | 08 | 21 | 03 |
| | 13 | 20 | 36 | 20 | 55 | 21 | 15 | 21 | 38 | 22 | 07 | 22 | 49 | 20 | 56 | 21 | 10 | 21 | 57 | 21 | 53 |
| | 14 | 21 | 27 | 21 | 44 | 22 | 01 | 22 | 22 | 22 | 47 | 23 | 23 | 21 | 42 | 21 | 58 | 22 | 40 | 22 | 39 |
| | 15 | 22 | 17 | 22 | 30 | 22 | 45 | 23 | 01 | 23 | 22 | 23 | 50 | 22 | 25 | 22 | 44 | 23 | 21 | 23 | 23 |
| | 16 | 23 | 05 | 23 | 15 | 23 | 26 | 23 | 38 | 23 | 52 | ** | ** | 23 | 05 | 23 | 28 | 23 | 58 | ** | ** |
| | 17 | 23 | 53 | 23 | 58 | ** | ** | ** | ** | ** | ** | 0 | 12 | 23 | 42 | ** | ** | ** | ** | 0 | 04 |
| | 18 | ** | ** | ** | ** | 0 | 04 | 0 | 11 | 0 | 20 | 0 | 31 | ** | ** | 0 | 09 | 0 | 32 | 0 | 43 |
| | 19 | 0 | 40 | 0 | 41 | 0 | 43 | 0 | 44 | 0 | 46 | 0 | 49 | 0 | 19 | 0 | 51 | 1 | 06 | 1 | 22 |
| | 20 | 1 | 28 | 1 | 25 | 1 | 22 | 1 | 18 | 1 | 14 | 1 | 07 | 0 | 57 | 1 | 33 | 1 | 40 | 2 | 02 |
| | 21 | 2 | 18 | 2 | 11 | 2 | 03 | 1 | 54 | 1 | 42 | 1 | 27 | 1 | 37 | 2 | 18 | 2 | 16 | 2 | 43 |
| | 22 | 3 | 13 | 3 | 01 | 2 | 48 | 2 | 33 | 2 | 15 | 1 | 50 | 2 | 20 | 3 | 06 | 2 | 57 | 3 | 29 |
| | 23 | 4 | 11 | 3 | 55 | 3 | 38 | 3 | 19 | 2 | 54 | 2 | 20 | 3 | 09 | 3 | 59 | 3 | 43 | 4 | 20 |
| | 24 | 5 | 14 | 4 | 55 | 4 | 34 | 4 | 11 | 3 | 42 | 2 | 60 | 4 | 04 | 4 | 58 | 4 | 36 | 5 | 17 |
| | 25 | 6 | 18 | 5 | 58 | 5 | 36 | 5 | 11 | 4 | 39 | 3 | 53 | 5 | 06 | 6 | 01 | 5 | 37 | 6 | 19 |
| | 26 | 7 | 22 | 7 | 02 | 6 | 41 | 6 | 16 | 5 | 45 | 4 | 59 | 6 | 11 | 7 | 05 | 6 | 42 | 7 | 24 |
| | 27 | 8 | 22 | 8 | 05 | 7 | 46 | 7 | 24 | 6 | 56 | 6 | 16 | 7 | 16 | 8 | 08 | 7 | 49 | 8 | 28 |
| | 28 | 9 | 18 | 9 | 04 | 8 | 48 | 8 | 30 | 8 | 08 | 7 | 36 | 8 | 19 | 9 | 08 | 8 | 55 | 9 | 30 |
| | 29 | 10 | 08 | 9 | 58 | 9 | 47 | 9 | 34 | 9 | 17 | 8 | 54 | 9 | 19 | 10 | 04 | 9 | 57 | 10 | 28 |
| | 30 | 10 | 55 | 10 | 48 | 10 | 41 | 10 | 33 | 10 | 23 | 10 | 09 | 10 | 15 | 10 | 55 | 10 | 56 | 11 | 22 |
| July | 1 | 11 | 38 | 11 | 36 | 11 | 33 | 11 | 30 | 11 | 26 | 11 | 21 | 11 | 08 | 11 | 44 | 11 | 52 | 12 | 13 |
| | 2 | 12 | 19 | 12 | 21 | 12 | 22 | 12 | 24 | 12 | 26 | 12 | 29 | 11 | 59 | 12 | 31 | 12 | 46 | 13 | 02 |
| | 3 | 13 | 01 | 13 | 06 | 13 | 12 | 13 | 18 | 13 | 26 | 13 | 37 | 12 | 49 | 13 | 17 | 13 | 39 | 13 | 51 |

The symbol (**) indicates that the phenomenon will occur on the next day

**MOONRISE, 2021**

LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONRISE (MOON'S UPPER LIMB)

| Date \ Lat. | FOR THE CENTRAL MERIDIAN OF INDIA ( 82º.5 E ) IN L. M. T. | | | | | | | | | | | | FOR CERTAIN STATIONS IN INDIA IN I.S.T. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0º | | 10º | | 20º | | 30º | | 40º | | 50º | | Kolkata | | Chennai | | Delhi | | Mumbai | |
| | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m |
| July 3 | 0 | 41 | 0 | 38 | 0 | 34 | 0 | 30 | 0 | 25 | 0 | 19 | 0 | 09 | 0 | 46 | 0 | 52 | 1 | 14 |
| 4 | 1 | 23 | 1 | 15 | 1 | 08 | 0 | 59 | 0 | 49 | 0 | 35 | 0 | 42 | 1 | 22 | 1 | 22 | 1 | 48 |
| 5 | 2 | 04 | 1 | 54 | 1 | 43 | 1 | 30 | 1 | 14 | 0 | 52 | 1 | 15 | 2 | 00 | 1 | 53 | 2 | 23 |
| 6 | 2 | 48 | 2 | 34 | 2 | 19 | 2 | 02 | 1 | 42 | 1 | 13 | 1 | 52 | 2 | 39 | 2 | 26 | 3 | 01 |
| 7 | 3 | 35 | 3 | 18 | 2 | 60 | 2 | 39 | 2 | 13 | 1 | 38 | 2 | 31 | 3 | 22 | 3 | 04 | 3 | 42 |
| 8 | 4 | 23 | 4 | 04 | 3 | 44 | 3 | 21 | 2 | 52 | 2 | 10 | 3 | 15 | 4 | 07 | 3 | 46 | 4 | 26 |
| 9 | 5 | 14 | 4 | 54 | 4 | 32 | 4 | 08 | 3 | 37 | 2 | 51 | 4 | 03 | 4 | 57 | 4 | 33 | 5 | 15 |
| 10 | 6 | 06 | 5 | 47 | 5 | 25 | 5 | 00 | 4 | 29 | 3 | 44 | 4 | 55 | 5 | 50 | 5 | 26 | 6 | 07 |
| 11 | 6 | 59 | 6 | 40 | 6 | 20 | 5 | 57 | 5 | 28 | 4 | 46 | 5 | 51 | 6 | 43 | 6 | 22 | 7 | 02 |
| 12 | 7 | 50 | 7 | 34 | 7 | 17 | 6 | 56 | 6 | 31 | 5 | 55 | 6 | 47 | 7 | 38 | 7 | 22 | 7 | 59 |
| 13 | 8 | 40 | 8 | 27 | 8 | 13 | 7 | 57 | 7 | 37 | 7 | 09 | 7 | 45 | 8 | 32 | 8 | 21 | 8 | 55 |
| 14 | 9 | 28 | 9 | 19 | 9 | 09 | 8 | 58 | 8 | 44 | 8 | 25 | 8 | 42 | 9 | 26 | 9 | 22 | 9 | 51 |
| 15 | 10 | 15 | 10 | 10 | 10 | 05 | 9 | 59 | 9 | 52 | 9 | 42 | 9 | 39 | 10 | 18 | 10 | 22 | 10 | 46 |
| 16 | 11 | 02 | 11 | 01 | 11 | 01 | 11 | 00 | 10 | 59 | 10 | 58 | 10 | 36 | 11 | 11 | 11 | 22 | 11 | 41 |
| 17 | 11 | 50 | 11 | 53 | 11 | 58 | 12 | 02 | 12 | 08 | 12 | 17 | 11 | 35 | 12 | 04 | 12 | 23 | 12 | 37 |
| 18 | 12 | 39 | 12 | 47 | 12 | 56 | 13 | 07 | 13 | 20 | 13 | 38 | 12 | 34 | 12 | 59 | 13 | 28 | 13 | 36 |
| 19 | 13 | 32 | 13 | 45 | 13 | 58 | 14 | 14 | 14 | 33 | 15 | 01 | 13 | 38 | 13 | 58 | 14 | 33 | 14 | 37 |
| 20 | 14 | 28 | 14 | 45 | 15 | 03 | 15 | 23 | 15 | 49 | 16 | 26 | 14 | 43 | 15 | 00 | 15 | 43 | 15 | 41 |
| 21 | 15 | 30 | 15 | 49 | 16 | 09 | 16 | 33 | 17 | 03 | 17 | 48 | 15 | 50 | 16 | 04 | 16 | 51 | 16 | 47 |
| 22 | 16 | 32 | 16 | 53 | 17 | 15 | 17 | 40 | 18 | 12 | 18 | 59 | 16 | 56 | 17 | 09 | 17 | 58 | 17 | 53 |
| 23 | 17 | 36 | 17 | 55 | 18 | 16 | 18 | 40 | 19 | 12 | 19 | 56 | 17 | 58 | 18 | 11 | 18 | 59 | 18 | 54 |
| 24 | 18 | 36 | 18 | 53 | 19 | 12 | 19 | 34 | 20 | 00 | 20 | 38 | 18 | 53 | 19 | 08 | 19 | 52 | 19 | 50 |
| 25 | 19 | 32 | 19 | 46 | 20 | 01 | 20 | 18 | 20 | 39 | 21 | 09 | 19 | 41 | 20 | 00 | 20 | 37 | 20 | 39 |
| 26 | 20 | 23 | 20 | 33 | 20 | 44 | 20 | 57 | 21 | 12 | 21 | 33 | 20 | 23 | 20 | 46 | 21 | 17 | 21 | 23 |
| 27 | 21 | 10 | 21 | 17 | 21 | 23 | 21 | 31 | 21 | 40 | 21 | 52 | 21 | 01 | 21 | 28 | 21 | 51 | 22 | 02 |
| 28 | 21 | 54 | 21 | 56 | 21 | 59 | 22 | 01 | 22 | 04 | 22 | 08 | 21 | 36 | 22 | 06 | 22 | 22 | 22 | 38 |
| 29 | 22 | 36 | 22 | 34 | 22 | 32 | 22 | 30 | 22 | 27 | 22 | 24 | 22 | 08 | 22 | 43 | 22 | 52 | 23 | 12 |
| 30 | 23 | 18 | 23 | 12 | 23 | 06 | 22 | 59 | 22 | 51 | 22 | 39 | 22 | 40 | 23 | 20 | 23 | 22 | 23 | 47 |
| 31 | ** | ** | 23 | 51 | 23 | 41 | 23 | 29 | 23 | 15 | 22 | 56 | 23 | 14 | 23 | 57 | 23 | 52 | ** | ** |
| Aug. 1 | 0 | 00 | ** | ** | ** | ** | ** | ** | 23 | 42 | 23 | 16 | 23 | 49 | ** | ** | ** | ** | 0 | 21 |
| 2 | 0 | 43 | 0 | 30 | 0 | 17 | 0 | 01 | ** | ** | 23 | 39 | ** | ** | 0 | 35 | 0 | 25 | 0 | 58 |
| 3 | 1 | 29 | 1 | 13 | 0 | 56 | 0 | 36 | 0 | 12 | ** | ** | 0 | 27 | 1 | 17 | 1 | 01 | 1 | 38 |
| 4 | 2 | 16 | 1 | 58 | 1 | 39 | 1 | 16 | 0 | 48 | 0 | 08 | 1 | 09 | 2 | 02 | 1 | 41 | 2 | 20 |
| 5 | 3 | 07 | 2 | 47 | 2 | 25 | 2 | 01 | 1 | 31 | 0 | 46 | 1 | 56 | 2 | 50 | 2 | 26 | 3 | 08 |
| 6 | 3 | 59 | 3 | 39 | 3 | 17 | 2 | 52 | 2 | 20 | 1 | 34 | 2 | 47 | 3 | 42 | 3 | 18 | 3 | 59 |
| 7 | 4 | 51 | 4 | 32 | 4 | 11 | 3 | 48 | 3 | 17 | 2 | 33 | 3 | 42 | 4 | 35 | 4 | 13 | 4 | 54 |
| 8 | 5 | 44 | 5 | 27 | 5 | 08 | 4 | 47 | 4 | 20 | 3 | 42 | 4 | 39 | 5 | 31 | 5 | 12 | 5 | 51 |
| 9 | 6 | 35 | 6 | 21 | 6 | 06 | 5 | 48 | 5 | 27 | 4 | 56 | 5 | 38 | 6 | 25 | 6 | 13 | 6 | 47 |
| 10 | 7 | 25 | 7 | 14 | 7 | 03 | 6 | 50 | 6 | 34 | 6 | 12 | 6 | 36 | 7 | 20 | 7 | 14 | 7 | 45 |
| 11 | 8 | 13 | 8 | 06 | 7 | 60 | 7 | 52 | 7 | 43 | 7 | 30 | 7 | 34 | 8 | 14 | 8 | 15 | 8 | 41 |
| 12 | 8 | 60 | 8 | 58 | 8 | 56 | 8 | 54 | 8 | 51 | 8 | 48 | 8 | 31 | 9 | 07 | 9 | 17 | 9 | 37 |
| 13 | 9 | 48 | 9 | 50 | 9 | 53 | 9 | 57 | 10 | 01 | 10 | 07 | 9 | 30 | 10 | 00 | 10 | 18 | 10 | 33 |
| 14 | 10 | 36 | 10 | 43 | 10 | 51 | 11 | 00 | 11 | 12 | 11 | 27 | 10 | 29 | 10 | 55 | 11 | 21 | 11 | 31 |
| 15 | 11 | 28 | 11 | 39 | 11 | 52 | 12 | 06 | 12 | 23 | 12 | 49 | 11 | 31 | 11 | 52 | 12 | 25 | 12 | 30 |
| 16 | 12 | 21 | 12 | 37 | 12 | 54 | 13 | 13 | 13 | 37 | 14 | 12 | 12 | 34 | 12 | 51 | 13 | 32 | 13 | 33 |
| 17 | 13 | 20 | 13 | 38 | 13 | 58 | 14 | 21 | 14 | 50 | 15 | 33 | 13 | 39 | 13 | 53 | 14 | 39 | 14 | 36 |
| 18 | 14 | 20 | 14 | 40 | 15 | 02 | 15 | 27 | 15 | 59 | 16 | 46 | 14 | 44 | 14 | 56 | 15 | 46 | 15 | 40 |

The symbol (**) indicates that the phenomenon will occur on the next day

**MOONSET, 2021**
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONSET (MOON'S UPPER LIMB)

| | FOR THE CENTRAL MERIDIAN OF INDIA ( 82º.5 E ) IN L. M. T. | | | | | | | | | | | | FOR CERTAIN STATIONS IN INDIA IN I.S.T. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date \ Lat. | 0º | | 10º | | 20º | | 30º | | 40º | | 50º | | Kolkata | | Chennai | | Delhi | | Mumbai | |
| | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m |
| July 3 | 13 | 01 | 13 | 06 | 13 | 12 | 13 | 18 | 13 | 26 | 13 | 37 | 12 | 49 | 13 | 17 | 13 | 39 | 13 | 51 |
| 4 | 13 | 42 | 13 | 51 | 14 | 01 | 14 | 12 | 14 | 25 | 14 | 44 | 13 | 39 | 14 | 03 | 14 | 32 | 14 | 39 |
| 5 | 14 | 25 | 14 | 37 | 14 | 51 | 15 | 06 | 15 | 25 | 15 | 52 | 14 | 30 | 14 | 51 | 15 | 26 | 15 | 30 |
| 6 | 15 | 10 | 15 | 26 | 15 | 42 | 16 | 01 | 16 | 25 | 16 | 59 | 15 | 23 | 15 | 40 | 16 | 20 | 16 | 20 |
| 7 | 15 | 57 | 16 | 15 | 16 | 34 | 16 | 57 | 17 | 25 | 18 | 06 | 16 | 15 | 16 | 30 | 17 | 16 | 17 | 13 |
| 8 | 16 | 47 | 17 | 07 | 17 | 28 | 17 | 52 | 18 | 23 | 19 | 08 | 17 | 09 | 17 | 22 | 18 | 10 | 18 | 05 |
| 9 | 17 | 39 | 17 | 59 | 18 | 20 | 18 | 45 | 19 | 17 | 20 | 03 | 18 | 02 | 18 | 14 | 19 | 04 | 18 | 58 |
| 10 | 18 | 31 | 18 | 51 | 19 | 11 | 19 | 35 | 20 | 05 | 20 | 48 | 18 | 53 | 19 | 06 | 19 | 54 | 19 | 49 |
| 11 | 19 | 24 | 19 | 41 | 19 | 59 | 20 | 21 | 20 | 47 | 21 | 25 | 19 | 41 | 19 | 56 | 20 | 39 | 20 | 37 |
| 12 | 20 | 14 | 20 | 29 | 20 | 44 | 21 | 02 | 21 | 24 | 21 | 54 | 20 | 24 | 20 | 42 | 21 | 21 | 21 | 23 |
| 13 | 21 | 03 | 21 | 14 | 21 | 26 | 21 | 39 | 21 | 56 | 22 | 18 | 21 | 05 | 21 | 27 | 21 | 59 | 22 | 04 |
| 14 | 21 | 51 | 21 | 58 | 22 | 05 | 22 | 13 | 22 | 24 | 22 | 37 | 21 | 43 | 22 | 09 | 22 | 34 | 22 | 44 |
| 15 | 22 | 37 | 22 | 40 | 22 | 43 | 22 | 46 | 22 | 50 | 22 | 56 | 22 | 20 | 22 | 50 | 23 | 08 | 23 | 23 |
| 16 | 23 | 25 | 23 | 23 | 23 | 21 | 23 | 19 | 23 | 17 | 23 | 13 | 22 | 56 | 23 | 32 | 23 | 41 | ** | ** |
| 17 | ** | ** | ** | ** | 23 | 60 | 23 | 53 | 23 | 44 | 23 | 32 | 23 | 34 | ** | ** | ** | ** | 0 | 01 |
| 18 | 0 | 13 | 0 | 06 | ** | ** | ** | ** | ** | ** | 23 | 52 | ** | ** | 0 | 14 | 0 | 15 | 0 | 40 |
| 19 | 1 | 04 | 0 | 53 | 0 | 42 | 0 | 29 | 0 | 13 | ** | ** | 0 | 15 | 0 | 59 | 0 | 53 | 1 | 23 |
| 20 | 1 | 59 | 1 | 44 | 1 | 29 | 1 | 11 | 0 | 49 | 0 | 18 | 1 | 00 | 1 | 49 | 1 | 35 | 2 | 10 |
| 21 | 2 | 57 | 2 | 39 | 2 | 20 | 1 | 58 | 1 | 31 | 0 | 52 | 1 | 51 | 2 | 43 | 2 | 23 | 3 | 03 |
| 22 | 3 | 60 | 3 | 40 | 3 | 19 | 2 | 54 | 2 | 22 | 1 | 38 | 2 | 48 | 3 | 43 | 3 | 20 | 4 | 01 |
| 23 | 5 | 03 | 4 | 43 | 4 | 21 | 3 | 56 | 3 | 24 | 2 | 37 | 3 | 51 | 4 | 46 | 4 | 22 | 5 | 04 |
| 24 | 6 | 05 | 5 | 46 | 5 | 26 | 5 | 03 | 4 | 33 | 3 | 50 | 4 | 56 | 5 | 50 | 5 | 28 | 6 | 09 |
| 25 | 7 | 03 | 6 | 47 | 6 | 30 | 6 | 10 | 5 | 45 | 5 | 09 | 6 | 01 | 6 | 52 | 6 | 35 | 7 | 12 |
| 26 | 7 | 57 | 7 | 45 | 7 | 31 | 7 | 16 | 6 | 57 | 6 | 30 | 7 | 03 | 7 | 50 | 7 | 40 | 8 | 13 |
| 27 | 8 | 46 | 8 | 37 | 8 | 28 | 8 | 18 | 8 | 05 | 7 | 48 | 8 | 02 | 8 | 44 | 8 | 42 | 9 | 10 |
| 28 | 9 | 32 | 9 | 27 | 9 | 23 | 9 | 18 | 9 | 11 | 9 | 02 | 8 | 57 | 9 | 35 | 9 | 40 | 10 | 03 |
| 29 | 10 | 14 | 10 | 14 | 10 | 14 | 10 | 14 | 10 | 14 | 10 | 13 | 9 | 50 | 10 | 23 | 10 | 36 | 10 | 54 |
| 30 | 10 | 56 | 11 | 00 | 11 | 04 | 11 | 09 | 11 | 15 | 11 | 23 | 10 | 41 | 11 | 11 | 11 | 30 | 11 | 44 |
| 31 | 11 | 38 | 11 | 46 | 11 | 54 | 12 | 03 | 12 | 15 | 12 | 31 | 11 | 32 | 11 | 57 | 12 | 23 | 12 | 33 |
| Aug. 1 | 12 | 20 | 12 | 31 | 12 | 44 | 12 | 58 | 13 | 15 | 13 | 39 | 12 | 23 | 12 | 44 | 13 | 18 | 13 | 23 |
| 2 | 13 | 05 | 13 | 19 | 13 | 35 | 13 | 53 | 14 | 15 | 14 | 47 | 13 | 15 | 13 | 33 | 14 | 12 | 14 | 13 |
| 3 | 13 | 51 | 14 | 08 | 14 | 27 | 14 | 48 | 15 | 15 | 15 | 54 | 14 | 08 | 14 | 23 | 15 | 07 | 15 | 05 |
| 4 | 14 | 40 | 14 | 59 | 15 | 20 | 15 | 44 | 16 | 14 | 16 | 58 | 15 | 01 | 15 | 15 | 16 | 02 | 15 | 58 |
| 5 | 15 | 31 | 15 | 52 | 16 | 13 | 16 | 38 | 17 | 10 | 17 | 56 | 15 | 55 | 16 | 07 | 16 | 56 | 16 | 51 |
| 6 | 16 | 24 | 16 | 43 | 17 | 05 | 17 | 30 | 18 | 00 | 18 | 45 | 16 | 46 | 16 | 59 | 17 | 48 | 17 | 43 |
| 7 | 17 | 17 | 17 | 35 | 17 | 54 | 18 | 17 | 18 | 45 | 19 | 25 | 17 | 36 | 17 | 50 | 18 | 35 | 18 | 32 |
| 8 | 18 | 08 | 18 | 24 | 18 | 41 | 18 | 60 | 19 | 24 | 19 | 57 | 18 | 21 | 18 | 38 | 19 | 19 | 19 | 19 |
| 9 | 18 | 59 | 19 | 11 | 19 | 24 | 19 | 39 | 19 | 57 | 20 | 22 | 19 | 04 | 19 | 25 | 19 | 58 | 20 | 02 |
| 10 | 19 | 48 | 19 | 56 | 20 | 05 | 20 | 15 | 20 | 27 | 20 | 43 | 19 | 43 | 20 | 08 | 20 | 35 | 20 | 43 |
| 11 | 20 | 35 | 20 | 39 | 20 | 43 | 20 | 48 | 20 | 54 | 21 | 02 | 20 | 20 | 20 | 50 | 21 | 09 | 21 | 23 |
| 12 | 21 | 23 | 21 | 22 | 21 | 22 | 21 | 21 | 21 | 20 | 21 | 19 | 20 | 57 | 21 | 31 | 21 | 43 | 22 | 01 |
| 13 | 22 | 10 | 22 | 05 | 22 | 00 | 21 | 54 | 21 | 47 | 21 | 37 | 21 | 35 | 22 | 13 | 22 | 17 | 22 | 40 |
| 14 | 23 | 00 | 22 | 51 | 22 | 41 | 22 | 29 | 22 | 15 | 21 | 57 | 22 | 14 | 22 | 57 | 22 | 53 | 23 | 22 |
| 15 | 23 | 53 | 23 | 40 | 23 | 25 | 23 | 09 | 22 | 48 | 22 | 20 | 22 | 57 | 23 | 45 | 23 | 33 | ** | ** |
| 16 | ** | ** | ** | ** | ** | ** | 23 | 53 | 23 | 27 | 22 | 50 | 23 | 45 | ** | ** | ** | ** | 0 | 06 |
| 17 | 0 | 49 | 0 | 32 | 0 | 14 | ** | ** | ** | ** | 23 | 30 | -- | --- | 0 | 36 | 0 | 18 | 0 | 56 |
| 18 | 1 | 49 | 1 | 29 | 1 | 08 | 0 | 44 | 0 | 14 | ** | ** | 0 | 38 | 1 | 32 | 1 | 10 | 1 | 51 |

The symbol (**) indicates that the phenomenon will occur on the next day

**MOONRISE, 2021**
LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONRISE (MOON'S UPPER LIMB)

| | FOR THE CENTRAL MERIDIAN OF INDIA ( 82º.5 E ) IN L. M. T. | | | | | | | | | | | | FOR CERTAIN STATIONS IN INDIA IN I.S.T. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date \ Lat. | 0º | | 10º | | 20º | | 30º | | 40º | | 50º | | Kolkata | | Chennai | | Delhi | | Mumbai | |
| | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m |
| Aug. 18 | 14 | 20 | 14 | 40 | 15 | 02 | 15 | 27 | 15 | 59 | 16 | 46 | 14 | 44 | 14 | 56 | 15 | 46 | 15 | 40 |
| 19 | 15 | 22 | 15 | 42 | 16 | 04 | 16 | 29 | 17 | 01 | 17 | 47 | 15 | 46 | 15 | 58 | 16 | 47 | 16 | 42 |
| 20 | 16 | 22 | 16 | 41 | 17 | 01 | 17 | 24 | 17 | 53 | 18 | 33 | 16 | 42 | 16 | 56 | 17 | 42 | 17 | 39 |
| 21 | 17 | 19 | 17 | 35 | 17 | 52 | 18 | 11 | 18 | 35 | 19 | 08 | 17 | 32 | 17 | 49 | 18 | 30 | 18 | 30 |
| 22 | 18 | 12 | 18 | 24 | 18 | 37 | 18 | 52 | 19 | 10 | 19 | 35 | 18 | 16 | 18 | 37 | 19 | 11 | 19 | 16 |
| 23 | 19 | 01 | 19 | 09 | 19 | 18 | 19 | 27 | 19 | 39 | 19 | 55 | 18 | 56 | 19 | 21 | 19 | 48 | 19 | 56 |
| 24 | 19 | 47 | 19 | 51 | 19 | 55 | 19 | 59 | 20 | 05 | 20 | 12 | 19 | 32 | 20 | 01 | 20 | 20 | 20 | 33 |
| 25 | 20 | 30 | 20 | 29 | 20 | 29 | 20 | 29 | 20 | 29 | 20 | 28 | 20 | 05 | 20 | 39 | 20 | 51 | 21 | 09 |
| 26 | 21 | 12 | 21 | 08 | 21 | 03 | 20 | 58 | 20 | 52 | 20 | 44 | 20 | 38 | 21 | 16 | 21 | 21 | 21 | 44 |
| 27 | 21 | 54 | 21 | 46 | 21 | 38 | 21 | 28 | 21 | 16 | 20 | 60 | 21 | 11 | 21 | 53 | 21 | 51 | 22 | 18 |
| 28 | 22 | 37 | 22 | 25 | 22 | 13 | 21 | 59 | 21 | 42 | 21 | 18 | 21 | 46 | 22 | 31 | 22 | 22 | 22 | 54 |
| 29 | 23 | 22 | 23 | 07 | 22 | 51 | 22 | 33 | 22 | 10 | 21 | 39 | 22 | 23 | 23 | 12 | 22 | 57 | 23 | 33 |
| 30 | ** | ** | 23 | 51 | 23 | 33 | 23 | 11 | 22 | 44 | 22 | 06 | 23 | 03 | 23 | 55 | 23 | 36 | ** | ** |
| 31 | 0 | 09 | ** | ** | ** | ** | 23 | 54 | 23 | 24 | 22 | 40 | 23 | 48 | ** | ** | ** | ** | 0 | 14 |
| Sept. 1 | 0 | 58 | 0 | 38 | 0 | 17 | ** | ** | ** | ** | 23 | 24 | ** | ** | 0 | 41 | 0 | 19 | 1 | 00 |
| 2 | 1 | 49 | 1 | 29 | 1 | 07 | 0 | 42 | 0 | 10 | ** | ** | 0 | 37 | 1 | 32 | 1 | 07 | 1 | 49 |
| 3 | 2 | 41 | 2 | 21 | 2 | 00 | 1 | 36 | 1 | 04 | 0 | 18 | 1 | 30 | 2 | 24 | 2 | 01 | 2 | 42 |
| 4 | 3 | 34 | 3 | 16 | 2 | 56 | 2 | 33 | 2 | 04 | 1 | 23 | 2 | 26 | 3 | 19 | 2 | 59 | 3 | 39 |
| 5 | 4 | 26 | 4 | 10 | 3 | 54 | 3 | 34 | 3 | 10 | 2 | 35 | 3 | 25 | 4 | 14 | 3 | 59 | 4 | 35 |
| 6 | 5 | 17 | 5 | 04 | 4 | 51 | 4 | 37 | 4 | 18 | 3 | 53 | 4 | 23 | 5 | 10 | 5 | 01 | 5 | 33 |
| 7 | 6 | 06 | 5 | 58 | 5 | 50 | 5 | 40 | 5 | 28 | 5 | 11 | 5 | 23 | 6 | 05 | 6 | 03 | 6 | 30 |
| 8 | 6 | 54 | 6 | 51 | 6 | 47 | 6 | 43 | 6 | 38 | 6 | 31 | 6 | 22 | 6 | 59 | 7 | 06 | 7 | 28 |
| 9 | 7 | 43 | 7 | 44 | 7 | 46 | 7 | 47 | 7 | 49 | 7 | 52 | 7 | 22 | 7 | 54 | 8 | 09 | 8 | 25 |
| 10 | 8 | 32 | 8 | 38 | 8 | 44 | 8 | 52 | 9 | 01 | 9 | 14 | 8 | 22 | 8 | 49 | 9 | 13 | 9 | 24 |
| 11 | 9 | 24 | 9 | 34 | 9 | 45 | 9 | 58 | 10 | 14 | 10 | 37 | 9 | 24 | 9 | 47 | 10 | 18 | 10 | 24 |
| 12 | 10 | 17 | 10 | 32 | 10 | 48 | 11 | 06 | 11 | 29 | 12 | 01 | 10 | 27 | 10 | 46 | 11 | 26 | 11 | 27 |
| 13 | 11 | 15 | 11 | 33 | 11 | 52 | 12 | 14 | 12 | 42 | 13 | 24 | 11 | 33 | 11 | 48 | 12 | 33 | 12 | 30 |
| 14 | 12 | 14 | 12 | 34 | 12 | 56 | 13 | 21 | 13 | 53 | 14 | 39 | 12 | 37 | 12 | 50 | 13 | 39 | 13 | 34 |
| 15 | 13 | 15 | 13 | 36 | 13 | 58 | 14 | 23 | 14 | 56 | 15 | 43 | 13 | 39 | 13 | 52 | 14 | 41 | 14 | 35 |
| 16 | 14 | 14 | 14 | 34 | 14 | 55 | 15 | 19 | 15 | 49 | 16 | 33 | 14 | 36 | 14 | 49 | 15 | 37 | 15 | 33 |
| 17 | 15 | 11 | 15 | 29 | 15 | 47 | 16 | 07 | 16 | 33 | 17 | 10 | 15 | 27 | 15 | 43 | 16 | 26 | 16 | 24 |
| 18 | 16 | 04 | 16 | 18 | 16 | 32 | 16 | 49 | 17 | 10 | 17 | 38 | 16 | 12 | 16 | 31 | 17 | 08 | 17 | 11 |
| 19 | 16 | 54 | 17 | 04 | 17 | 14 | 17 | 26 | 17 | 40 | 17 | 59 | 16 | 53 | 17 | 16 | 17 | 46 | 17 | 53 |
| 20 | 17 | 40 | 17 | 46 | 17 | 52 | 17 | 58 | 18 | 06 | 18 | 17 | 17 | 29 | 17 | 57 | 18 | 19 | 18 | 30 |
| 21 | 18 | 24 | 18 | 25 | 18 | 27 | 18 | 28 | 18 | 30 | 18 | 33 | 18 | 03 | 18 | 35 | 18 | 50 | 19 | 06 |
| 22 | 19 | 07 | 19 | 04 | 19 | 01 | 18 | 58 | 18 | 54 | 18 | 48 | 18 | 36 | 19 | 12 | 19 | 20 | 19 | 41 |
| 23 | 19 | 49 | 19 | 42 | 19 | 35 | 19 | 27 | 19 | 17 | 19 | 04 | 19 | 09 | 19 | 49 | 19 | 50 | 20 | 15 |
| 24 | 20 | 31 | 20 | 21 | 20 | 10 | 19 | 58 | 19 | 42 | 19 | 21 | 19 | 43 | 20 | 27 | 20 | 21 | 20 | 51 |
| 25 | 21 | 16 | 21 | 02 | 20 | 47 | 20 | 30 | 20 | 09 | 19 | 41 | 20 | 19 | 21 | 07 | 20 | 54 | 21 | 29 |
| 26 | 22 | 02 | 21 | 45 | 21 | 27 | 21 | 06 | 20 | 41 | 20 | 05 | 20 | 58 | 21 | 49 | 21 | 31 | 22 | 08 |
| 27 | 22 | 50 | 22 | 30 | 22 | 10 | 21 | 47 | 21 | 18 | 20 | 35 | 21 | 41 | 22 | 34 | 22 | 12 | 22 | 52 |
| 28 | 23 | 40 | 23 | 20 | 22 | 58 | 22 | 32 | 22 | 01 | 21 | 15 | 22 | 27 | 23 | 22 | 22 | 58 | 23 | 40 |
| 29 | ** | ** | ** | ** | 23 | 49 | 23 | 24 | 22 | 51 | 22 | 04 | 23 | 19 | ** | ** | 23 | 49 | ** | ** |
| 30 | 0 | 31 | 0 | 10 | ** | ** | ** | ** | 23 | 49 | 23 | 04 | ** | ** | 0 | 13 | ** | ** | 0 | 31 |
| Oct. 1 | 1 | 23 | 1 | 04 | 0 | 43 | 0 | 19 | ** | ** | ** | ** | 0 | 13 | 1 | 07 | 0 | 44 | 1 | 25 |
| 2 | 2 | 14 | 1 | 57 | 1 | 39 | 1 | 18 | 0 | 51 | 0 | 13 | 1 | 10 | 2 | 01 | 1 | 43 | 2 | 21 |
| 3 | 3 | 05 | 2 | 51 | 2 | 36 | 2 | 19 | 1 | 58 | 1 | 28 | 2 | 08 | 2 | 56 | 2 | 44 | 3 | 18 |

The symbol (**) indicates that the phenomenon will occur on the next day

**MOONSET, 2021**

LOCAL MEAN TIME AND INDIAN STANDARD TIME OF MOONSET (MOON'S UPPER LIMB)

| | FOR THE CENTRAL MERIDIAN OF INDIA ( 82º.5 E ) IN L. M. T. | | | | | | | | | | | | FOR CERTAIN STATIONS IN INDIA IN I.S.T. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date \ Lat. | 0º | | 10º | | 20º | | 30º | | 40º | | 50º | | Kolkata | | Chennai | | Delhi | | Mumbai | |
| | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m |
| Aug. 18 | 1 | 49 | 1 | 29 | 1 | 08 | 0 | 44 | 0 | 14 | ** | ** | 0 | 38 | 1 | 32 | 1 | 10 | 1 | 51 |
| 19 | 2 | 50 | 2 | 29 | 2 | 08 | 1 | 43 | 1 | 10 | 0 | 23 | 1 | 38 | 2 | 32 | 2 | 08 | 2 | 50 |
| 20 | 3 | 51 | 3 | 32 | 3 | 11 | 2 | 46 | 2 | 15 | 1 | 30 | 2 | 40 | 3 | 35 | 3 | 12 | 3 | 53 |
| 21 | 4 | 50 | 4 | 32 | 4 | 14 | 3 | 52 | 3 | 25 | 2 | 45 | 3 | 45 | 4 | 36 | 4 | 17 | 4 | 56 |
| 22 | 5 | 45 | 5 | 31 | 5 | 16 | 4 | 58 | 4 | 36 | 4 | 05 | 4 | 47 | 5 | 36 | 5 | 23 | 5 | 58 |
| 23 | 6 | 36 | 6 | 25 | 6 | 15 | 6 | 02 | 5 | 47 | 5 | 25 | 5 | 48 | 6 | 32 | 6 | 26 | 6 | 56 |
| 24 | 7 | 23 | 7 | 17 | 7 | 11 | 7 | 03 | 6 | 54 | 6 | 41 | 6 | 44 | 7 | 25 | 7 | 26 | 7 | 51 |
| 25 | 8 | 07 | 8 | 05 | 8 | 04 | 8 | 01 | 7 | 59 | 7 | 55 | 7 | 39 | 8 | 14 | 8 | 23 | 8 | 44 |
| 26 | 8 | 50 | 8 | 52 | 8 | 55 | 8 | 58 | 9 | 01 | 9 | 06 | 8 | 31 | 9 | 02 | 9 | 19 | 9 | 35 |
| 27 | 9 | 32 | 9 | 39 | 9 | 45 | 9 | 53 | 10 | 02 | 10 | 15 | 9 | 23 | 9 | 50 | 10 | 13 | 10 | 24 |
| 28 | 10 | 14 | 10 | 24 | 10 | 35 | 10 | 48 | 11 | 03 | 11 | 24 | 10 | 14 | 10 | 37 | 11 | 08 | 11 | 14 |
| 29 | 10 | 58 | 11 | 12 | 11 | 26 | 11 | 43 | 12 | 04 | 12 | 32 | 11 | 06 | 11 | 26 | 12 | 02 | 12 | 05 |
| 30 | 11 | 44 | 12 | 00 | 12 | 18 | 12 | 38 | 13 | 04 | 13 | 41 | 11 | 59 | 12 | 15 | 12 | 57 | 12 | 56 |
| 31 | 12 | 32 | 12 | 51 | 13 | 11 | 13 | 34 | 14 | 03 | 14 | 46 | 12 | 52 | 13 | 06 | 13 | 53 | 13 | 49 |
| Sept. 1 | 13 | 22 | 13 | 42 | 14 | 04 | 14 | 28 | 15 | 00 | 15 | 46 | 13 | 45 | 13 | 58 | 14 | 47 | 14 | 41 |
| 2 | 14 | 14 | 14 | 34 | 14 | 56 | 15 | 21 | 15 | 53 | 16 | 39 | 14 | 37 | 14 | 50 | 15 | 39 | 15 | 34 |
| 3 | 15 | 07 | 15 | 26 | 15 | 46 | 16 | 10 | 16 | 39 | 17 | 22 | 15 | 28 | 15 | 41 | 16 | 28 | 16 | 24 |
| 4 | 15 | 59 | 16 | 16 | 16 | 34 | 16 | 55 | 17 | 21 | 17 | 57 | 16 | 15 | 16 | 30 | 17 | 13 | 17 | 12 |
| 5 | 16 | 50 | 17 | 04 | 17 | 19 | 17 | 36 | 17 | 56 | 18 | 24 | 16 | 59 | 17 | 18 | 17 | 55 | 17 | 57 |
| 6 | 17 | 40 | 17 | 50 | 18 | 01 | 18 | 12 | 18 | 27 | 18 | 47 | 17 | 40 | 18 | 02 | 18 | 32 | 18 | 39 |
| 7 | 18 | 29 | 18 | 34 | 18 | 40 | 18 | 47 | 18 | 56 | 19 | 07 | 18 | 18 | 18 | 46 | 19 | 08 | 19 | 20 |
| 8 | 19 | 18 | 19 | 19 | 19 | 20 | 19 | 21 | 19 | 23 | 19 | 25 | 18 | 56 | 19 | 28 | 19 | 43 | 19 | 59 |
| 9 | 20 | 06 | 20 | 03 | 19 | 59 | 19 | 55 | 19 | 49 | 19 | 43 | 19 | 34 | 20 | 11 | 20 | 17 | 20 | 39 |
| 10 | 20 | 56 | 20 | 48 | 20 | 39 | 20 | 30 | 20 | 17 | 20 | 01 | 20 | 13 | 20 | 55 | 20 | 53 | 21 | 20 |
| 11 | 21 | 49 | 21 | 37 | 21 | 23 | 21 | 08 | 20 | 49 | 20 | 24 | 20 | 55 | 21 | 42 | 21 | 32 | 22 | 04 |
| 12 | 22 | 44 | 22 | 28 | 22 | 11 | 21 | 51 | 21 | 27 | 20 | 52 | 21 | 42 | 22 | 32 | 22 | 16 | 22 | 53 |
| 13 | 23 | 43 | 23 | 24 | 23 | 04 | 22 | 40 | 22 | 10 | 21 | 28 | 22 | 34 | 23 | 28 | 23 | 05 | 23 | 46 |
| 14 | ** | ** | ** | ** | ** | ** | 23 | 36 | 23 | 03 | 22 | 16 | 23 | 31 | ** | ** | ** | ** | ** | ** |
| 15 | 0 | 43 | 0 | 23 | 0 | 01 | ** | ** | ** | ** | 23 | 18 | ** | ** | 0 | 26 | 0 | 01 | 0 | 43 |
| 16 | 1 | 44 | 1 | 24 | 1 | 02 | 0 | 36 | 0 | 04 | ** | ** | 0 | 31 | 1 | 27 | 1 | 02 | 1 | 45 |
| 17 | 2 | 42 | 2 | 24 | 2 | 04 | 1 | 41 | 1 | 12 | 0 | 29 | 1 | 34 | 2 | 27 | 2 | 06 | 2 | 46 |
| 18 | 3 | 37 | 3 | 22 | 3 | 05 | 2 | 46 | 2 | 21 | 1 | 47 | 2 | 36 | 3 | 26 | 3 | 11 | 3 | 47 |
| 19 | 4 | 28 | 4 | 16 | 4 | 04 | 3 | 50 | 3 | 31 | 3 | 06 | 3 | 37 | 4 | 22 | 4 | 13 | 4 | 45 |
| 20 | 5 | 16 | 5 | 09 | 5 | 00 | 4 | 51 | 4 | 39 | 4 | 22 | 4 | 33 | 5 | 15 | 5 | 14 | 5 | 41 |
| 21 | 6 | 01 | 5 | 58 | 5 | 54 | 5 | 50 | 5 | 44 | 5 | 37 | 5 | 29 | 6 | 06 | 6 | 12 | 6 | 34 |
| 22 | 6 | 44 | 6 | 45 | 6 | 45 | 6 | 46 | 6 | 47 | 6 | 49 | 6 | 21 | 6 | 54 | 7 | 08 | 7 | 26 |
| 23 | 7 | 27 | 7 | 32 | 7 | 37 | 7 | 42 | 7 | 50 | 7 | 59 | 7 | 14 | 7 | 42 | 8 | 03 | 8 | 16 |
| 24 | 8 | 09 | 8 | 17 | 8 | 27 | 8 | 37 | 8 | 51 | 9 | 09 | 8 | 05 | 8 | 29 | 8 | 58 | 9 | 06 |
| 25 | 8 | 52 | 9 | 05 | 9 | 18 | 9 | 33 | 9 | 52 | 10 | 18 | 8 | 57 | 9 | 18 | 9 | 53 | 9 | 56 |
| 26 | 9 | 38 | 9 | 53 | 10 | 09 | 10 | 28 | 10 | 53 | 11 | 27 | 9 | 50 | 10 | 07 | 10 | 48 | 10 | 47 |
| 27 | 10 | 24 | 10 | 42 | 11 | 02 | 11 | 24 | 11 | 53 | 12 | 33 | 10 | 43 | 10 | 57 | 11 | 43 | 11 | 40 |
| 28 | 11 | 13 | 11 | 33 | 11 | 55 | 12 | 19 | 12 | 50 | 13 | 36 | 11 | 36 | 11 | 49 | 12 | 37 | 12 | 32 |
| 29 | 12 | 04 | 12 | 24 | 12 | 46 | 13 | 12 | 13 | 45 | 14 | 31 | 12 | 28 | 12 | 40 | 13 | 30 | 13 | 24 |
| 30 | 12 | 56 | 13 | 16 | 13 | 37 | 14 | 02 | 14 | 33 | 15 | 18 | 13 | 19 | 13 | 32 | 14 | 20 | 14 | 15 |
| Oct. 1 | 13 | 48 | 14 | 06 | 14 | 25 | 14 | 48 | 15 | 16 | 15 | 56 | 14 | 06 | 14 | 21 | 15 | 06 | 15 | 03 |
| 2 | 14 | 39 | 14 | 54 | 15 | 11 | 15 | 30 | 15 | 53 | 16 | 25 | 14 | 51 | 15 | 09 | 15 | 49 | 15 | 49 |
| 3 | 15 | 29 | 15 | 41 | 15 | 54 | 16 | 08 | 16 | 25 | 16 | 49 | 15 | 33 | 15 | 54 | 16 | 27 | 16 | 32 |

The symbol (**) indicates that the phenomenon will occur on the next day

**MOONRISE, 2021**

LOCAL MEAN TIME AND INDIAN STANDARD TIME OF
MOONRISE (MOON'S UPPER LIMB)

| | FOR THE CENTRAL MERIDIAN OF INDIA ( 82º.5 E ) IN L. M. T. | | | | | | FOR CERTAIN STATIONS IN INDIA IN I.S.T. | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Date \ Lat. | 0º | 10º | 20º | 30º | 40º | 50º | Kolkata | Chennai | Delhi | Mumbai |
| | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m |
| Oct. 3 | 3 05 | 2 51 | 2 36 | 2 19 | 1 58 | 1 28 | 2 08 | 2 56 | 2 44 | 3 18 |
| 4 | 3 55 | 3 45 | 3 34 | 3 22 | 3 07 | 2 45 | 3 07 | 3 51 | 3 46 | 4 15 |
| 5 | 4 43 | 4 38 | 4 32 | 4 25 | 4 17 | 4 05 | 4 06 | 4 45 | 4 48 | 5 13 |
| 6 | 5 33 | 5 32 | 5 31 | 5 30 | 5 29 | 5 27 | 5 06 | 5 41 | 5 52 | 6 11 |
| 7 | 6 22 | 6 26 | 6 30 | 6 35 | 6 41 | 6 50 | 6 07 | 6 37 | 6 57 | 7 10 |
| 8 | 7 14 | 7 23 | 7 33 | 7 43 | 7 57 | 8 15 | 7 11 | 7 35 | 8 04 | 8 11 |
| 9 | 8 09 | 8 22 | 8 36 | 8 53 | 9 14 | 9 43 | 8 16 | 8 36 | 9 13 | 9 15 |
| 10 | 9 07 | 9 24 | 9 43 | 10 04 | 10 30 | 11 09 | 9 23 | 9 39 | 10 22 | 10 21 |
| 11 | 10 07 | 10 27 | 10 48 | 11 13 | 11 45 | 12 30 | 10 30 | 10 43 | 11 32 | 11 27 |
| 12 | 11 09 | 11 30 | 11 53 | 12 18 | 12 51 | 13 40 | 11 34 | 11 46 | 12 36 | 12 30 |
| 13 | 12 10 | 12 30 | 12 52 | 13 17 | 13 48 | 14 34 | 12 33 | 12 46 | 13 35 | 13 30 |
| 14 | 13 08 | 13 26 | 13 45 | 14 07 | 14 34 | 15 14 | 13 26 | 13 41 | 14 25 | 14 22 |
| 15 | 14 01 | 14 16 | 14 32 | 14 50 | 15 13 | 15 44 | 14 12 | 14 30 | 15 09 | 15 10 |
| 16 | 14 51 | 15 02 | 15 14 | 15 27 | 15 44 | 16 06 | 14 53 | 15 15 | 15 47 | 15 52 |
| 17 | 15 37 | 15 44 | 15 52 | 16 00 | 16 10 | 16 24 | 15 30 | 15 56 | 16 20 | 16 30 |
| 18 | 16 20 | 16 23 | 16 27 | 16 30 | 16 34 | 16 40 | 16 04 | 16 34 | 16 51 | 17 06 |
| 19 | 17 03 | 17 02 | 17 01 | 16 59 | 16 58 | 16 55 | 16 36 | 17 11 | 17 21 | 17 41 |
| 20 | 17 45 | 17 40 | 17 34 | 17 28 | 17 21 | 17 10 | 17 09 | 17 47 | 17 51 | 18 14 |
| 21 | 18 27 | 18 18 | 18 08 | 17 58 | 17 44 | 17 26 | 17 42 | 18 24 | 18 21 | 18 49 |
| 22 | 19 11 | 18 58 | 18 45 | 18 29 | 18 10 | 17 45 | 18 17 | 19 03 | 18 53 | 19 26 |
| 23 | 19 56 | 19 41 | 19 24 | 19 04 | 18 40 | 18 06 | 18 55 | 19 45 | 19 29 | 20 05 |
| 24 | 20 43 | 20 25 | 20 05 | 19 43 | 19 15 | 18 34 | 19 36 | 20 28 | 20 08 | 20 47 |
| 25 | 21 33 | 21 13 | 20 51 | 20 26 | 19 55 | 19 09 | 20 21 | 21 16 | 20 52 | 21 34 |
| 26 | 22 23 | 22 02 | 21 41 | 21 15 | 20 42 | 19 54 | 21 10 | 22 05 | 21 40 | 22 22 |
| 27 | 23 14 | 22 54 | 22 32 | 22 08 | 21 36 | 20 50 | 22 02 | 22 57 | 22 33 | 23 15 |
| 28 | ** ** | 23 47 | 23 27 | 23 04 | 22 35 | 21 54 | 22 57 | 23 50 | 23 30 | ** ** |
| 29 | 0 05 | ** ** | ** ** | ** ** | 23 39 | 23 05 | 23 54 | ** ** | ** ** | 0 09 |
| 30 | 0 55 | 0 39 | 0 22 | 0 03 | ** ** | ** ** | ** ** | 0 43 | 0 28 | 1 05 |
| 31 | 1 44 | 1 32 | 1 19 | 1 04 | 0 45 | 0 20 | 0 51 | 1 37 | 1 28 | 2 00 |
| Nov. 1 | 2 31 | 2 23 | 2 15 | 2 05 | 1 54 | 1 37 | 1 49 | 2 30 | 2 29 | 2 56 |
| 2 | 3 20 | 3 16 | 3 13 | 3 08 | 3 03 | 2 56 | 2 47 | 3 24 | 3 31 | 3 53 |
| 3 | 4 08 | 4 09 | 4 11 | 4 13 | 4 15 | 4 18 | 3 47 | 4 19 | 4 34 | 4 51 |
| 4 | 4 59 | 5 05 | 5 12 | 5 20 | 5 30 | 5 43 | 4 49 | 5 17 | 5 41 | 5 52 |
| 5 | 5 53 | 6 04 | 6 16 | 6 30 | 6 47 | 7 11 | 5 55 | 6 17 | 6 50 | 6 55 |
| 6 | 6 51 | 7 07 | 7 23 | 7 43 | 8 07 | 8 41 | 7 03 | 7 21 | 8 02 | 8 02 |
| 7 | 7 53 | 8 12 | 8 32 | 8 55 | 9 26 | 10 09 | 8 13 | 8 27 | 9 14 | 9 10 |
| 8 | 8 57 | 9 18 | 9 40 | 10 06 | 10 39 | 11 27 | 9 22 | 9 34 | 10 24 | 10 18 |
| 9 | 10 01 | 10 21 | 10 43 | 11 09 | 11 42 | 12 29 | 10 25 | 10 37 | 11 28 | 11 22 |
| 10 | 11 01 | 11 21 | 11 41 | 12 04 | 12 33 | 13 16 | 11 22 | 11 36 | 12 22 | 12 18 |
| 11 | 11 58 | 12 14 | 12 31 | 12 50 | 13 15 | 13 49 | 12 11 | 12 28 | 13 09 | 13 09 |
| 12 | 12 49 | 13 01 | 13 15 | 13 30 | 13 48 | 14 13 | 12 54 | 13 15 | 13 49 | 13 53 |
| 13 | 13 36 | 13 45 | 13 54 | 14 03 | 14 16 | 14 32 | 13 32 | 13 56 | 14 23 | 14 32 |
| 14 | 14 20 | 14 24 | 14 29 | 14 34 | 14 40 | 14 49 | 14 06 | 14 35 | 14 55 | 15 08 |
| 15 | 15 02 | 15 02 | 15 03 | 15 03 | 15 03 | 15 04 | 14 39 | 15 12 | 15 25 | 15 42 |
| 16 | 15 44 | 15 40 | 15 36 | 15 31 | 15 26 | 15 18 | 15 11 | 15 48 | 15 53 | 16 15 |
| 17 | 16 25 | 16 17 | 16 09 | 15 60 | 15 49 | 15 33 | 15 43 | 16 24 | 16 23 | 16 50 |
| 18 | 17 08 | 16 57 | 16 44 | 16 30 | 16 13 | 15 50 | 16 17 | 17 02 | 16 54 | 17 26 |

The symbol (**) indicates that the phenomenon will occur on the next day

**MOONSET, 2021**

LOCAL MEAN TIME AND INDIAN STANDARD TIME OF MOONSET (MOON'S UPPER LIMB)

| Date | | FOR THE CENTRAL MERIDIAN OF INDIA ( 82º.5 E ) IN L. M. T. | | | | | | | | | | | | FOR CERTAIN STATIONS IN INDIA IN I.S.T. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lat. | | 0º | | 10º | | 20º | | 30º | | 40º | | 50º | | Kolkata | | Chennai | | Delhi | | Mumbai | |
| | | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m |
| Oct. | 3 | 15 | 29 | 15 | 41 | 15 | 54 | 16 | 08 | 16 | 25 | 16 | 49 | 15 | 33 | 15 | 54 | 16 | 27 | 16 | 32 |
| | 4 | 16 | 18 | 16 | 26 | 16 | 34 | 16 | 43 | 16 | 55 | 17 | 10 | 16 | 12 | 16 | 37 | 17 | 04 | 17 | 13 |
| | 5 | 17 | 07 | 17 | 10 | 17 | 14 | 17 | 18 | 17 | 22 | 17 | 28 | 16 | 50 | 17 | 21 | 17 | 39 | 17 | 53 |
| | 6 | 17 | 56 | 17 | 55 | 17 | 53 | 17 | 51 | 17 | 49 | 17 | 46 | 17 | 29 | 18 | 03 | 18 | 13 | 18 | 33 |
| | 7 | 18 | 47 | 18 | 40 | 18 | 34 | 18 | 26 | 18 | 17 | 18 | 04 | 18 | 08 | 18 | 48 | 18 | 49 | 19 | 15 |
| | 8 | 19 | 40 | 19 | 29 | 19 | 18 | 19 | 04 | 18 | 48 | 18 | 26 | 18 | 50 | 19 | 35 | 19 | 28 | 19 | 59 |
| | 9 | 20 | 36 | 20 | 21 | 20 | 05 | 19 | 47 | 19 | 24 | 18 | 52 | 19 | 37 | 20 | 25 | 20 | 11 | 20 | 47 |
| | 10 | 21 | 36 | 21 | 17 | 20 | 58 | 20 | 35 | 20 | 06 | 19 | 26 | 20 | 28 | 21 | 21 | 21 | 00 | 21 | 40 |
| | 11 | 22 | 37 | 22 | 17 | 21 | 55 | 21 | 30 | 20 | 57 | 20 | 10 | 21 | 25 | 22 | 19 | 21 | 55 | 22 | 37 |
| | 12 | 23 | 39 | 23 | 18 | 22 | 56 | 22 | 30 | 21 | 57 | 21 | 09 | 22 | 25 | 23 | 21 | 22 | 56 | 23 | 39 |
| | 13 | ** | ** | ** | ** | 23 | 58 | 23 | 34 | 23 | 03 | 22 | 18 | 23 | 28 | ** | ** | 24 | 00 | ** | ** |
| | 14 | 0 | 38 | 0 | 19 | ** | ** | ** | ** | ** | ** | 23 | 35 | ** | ** | 0 | 22 | ** | ** | 0 | 40 |
| | 15 | 1 | 34 | 1 | 17 | 0 | 59 | 0 | 38 | 0 | 12 | ** | ** | 0 | 30 | 1 | 21 | 1 | 04 | 1 | 42 |
| | 16 | 2 | 25 | 2 | 12 | 1 | 58 | 1 | 42 | 1 | 22 | 0 | 53 | 1 | 30 | 2 | 17 | 2 | 06 | 2 | 40 |
| | 17 | 3 | 13 | 3 | 04 | 2 | 54 | 2 | 43 | 2 | 28 | 2 | 09 | 2 | 27 | 3 | 10 | 3 | 06 | 3 | 35 |
| | 18 | 3 | 58 | 3 | 53 | 3 | 48 | 3 | 42 | 3 | 34 | 3 | 23 | 3 | 22 | 4 | 01 | 4 | 04 | 4 | 28 |
| | 19 | 4 | 41 | 4 | 40 | 4 | 39 | 4 | 38 | 4 | 36 | 4 | 34 | 4 | 14 | 4 | 49 | 5 | 00 | 5 | 19 |
| | 20 | 5 | 23 | 5 | 26 | 5 | 30 | 5 | 34 | 5 | 39 | 5 | 45 | 5 | 06 | 5 | 37 | 5 | 55 | 6 | 09 |
| | 21 | 6 | 05 | 6 | 12 | 6 | 20 | 6 | 29 | 6 | 40 | 6 | 55 | 5 | 58 | 6 | 23 | 6 | 49 | 6 | 59 |
| | 22 | 6 | 48 | 6 | 59 | 7 | 11 | 7 | 24 | 7 | 41 | 8 | 04 | 6 | 49 | 7 | 12 | 7 | 44 | 7 | 49 |
| | 23 | 7 | 32 | 7 | 47 | 8 | 02 | 8 | 20 | 8 | 42 | 9 | 14 | 7 | 42 | 8 | 00 | 8 | 39 | 8 | 40 |
| | 24 | 8 | 18 | 8 | 36 | 8 | 54 | 9 | 16 | 9 | 43 | 10 | 22 | 8 | 35 | 8 | 50 | 9 | 35 | 9 | 33 |
| | 25 | 9 | 07 | 9 | 26 | 9 | 47 | 10 | 11 | 10 | 42 | 11 | 27 | 9 | 29 | 9 | 42 | 10 | 29 | 10 | 24 |
| | 26 | 9 | 57 | 10 | 17 | 10 | 39 | 11 | 05 | 11 | 37 | 12 | 25 | 10 | 21 | 10 | 33 | 11 | 23 | 11 | 17 |
| | 27 | 10 | 47 | 11 | 08 | 11 | 30 | 11 | 55 | 12 | 27 | 13 | 15 | 11 | 12 | 11 | 24 | 12 | 13 | 12 | 07 |
| | 28 | 11 | 39 | 11 | 58 | 12 | 18 | 12 | 42 | 13 | 12 | 13 | 55 | 12 | 00 | 12 | 13 | 13 | 00 | 12 | 56 |
| | 29 | 12 | 29 | 12 | 46 | 13 | 04 | 13 | 25 | 13 | 50 | 14 | 26 | 12 | 44 | 13 | 00 | 13 | 43 | 13 | 42 |
| | 30 | 13 | 18 | 13 | 32 | 13 | 47 | 14 | 03 | 14 | 23 | 14 | 52 | 13 | 27 | 13 | 46 | 14 | 22 | 14 | 24 |
| | 31 | 14 | 06 | 14 | 16 | 14 | 27 | 14 | 39 | 14 | 53 | 15 | 13 | 14 | 06 | 14 | 28 | 14 | 59 | 15 | 05 |
| Nov. | 1 | 14 | 54 | 14 | 60 | 15 | 06 | 15 | 13 | 15 | 21 | 15 | 32 | 14 | 43 | 15 | 11 | 15 | 33 | 15 | 45 |
| | 2 | 15 | 43 | 15 | 44 | 15 | 45 | 15 | 46 | 15 | 47 | 15 | 49 | 15 | 21 | 15 | 53 | 16 | 07 | 16 | 24 |
| | 3 | 16 | 32 | 16 | 28 | 16 | 24 | 16 | 20 | 16 | 14 | 16 | 07 | 15 | 59 | 16 | 36 | 16 | 42 | 17 | 05 |
| | 4 | 17 | 25 | 17 | 16 | 17 | 07 | 16 | 56 | 16 | 43 | 16 | 26 | 16 | 40 | 17 | 23 | 17 | 20 | 17 | 48 |
| | 5 | 18 | 20 | 18 | 07 | 17 | 53 | 17 | 37 | 17 | 17 | 16 | 50 | 17 | 25 | 18 | 12 | 18 | 01 | 18 | 34 |
| | 6 | 19 | 21 | 19 | 03 | 18 | 45 | 18 | 23 | 17 | 57 | 17 | 21 | 18 | 15 | 19 | 07 | 18 | 49 | 19 | 27 |
| | 7 | 20 | 23 | 20 | 04 | 19 | 42 | 19 | 18 | 18 | 46 | 18 | 01 | 19 | 12 | 20 | 06 | 19 | 43 | 20 | 25 |
| | 8 | 21 | 28 | 21 | 07 | 20 | 44 | 20 | 18 | 19 | 45 | 18 | 56 | 20 | 14 | 21 | 10 | 20 | 44 | 21 | 27 |
| | 9 | 22 | 30 | 22 | 10 | 21 | 49 | 21 | 24 | 20 | 51 | 20 | 05 | 21 | 19 | 22 | 13 | 21 | 50 | 22 | 31 |
| | 10 | 23 | 29 | 23 | 11 | 22 | 52 | 22 | 30 | 22 | 02 | 21 | 22 | 22 | 22 | 23 | 15 | 22 | 55 | 23 | 35 |
| | 11 | ** | ** | ** | ** | 23 | 53 | 23 | 35 | 23 | 13 | 22 | 41 | 23 | 25 | ** | ** | 24 | 00 | ** | ** |
| | 12 | 0 | 23 | 0 | 08 | ** | ** | ** | ** | ** | ** | 23 | 59 | ** | ** | 0 | 13 | ** | ** | 0 | 35 |
| | 13 | 1 | 12 | 1 | 01 | 0 | 50 | 0 | 37 | 0 | 21 | ** | ** | 0 | 23 | 1 | 07 | 1 | 01 | 1 | 32 |
| | 14 | 1 | 57 | 1 | 51 | 1 | 44 | 1 | 36 | 1 | 27 | 1 | 13 | 1 | 18 | 1 | 58 | 1 | 59 | 2 | 25 |
| | 15 | 2 | 40 | 2 | 38 | 2 | 35 | 2 | 33 | 2 | 29 | 2 | 24 | 2 | 11 | 2 | 46 | 2 | 55 | 3 | 16 |
| | 16 | 3 | 22 | 3 | 24 | 3 | 26 | 3 | 28 | 3 | 31 | 3 | 35 | 3 | 02 | 3 | 34 | 3 | 50 | 4 | 05 |
| | 17 | 4 | 03 | 4 | 09 | 4 | 15 | 4 | 22 | 4 | 31 | 4 | 44 | 3 | 53 | 4 | 20 | 4 | 43 | 4 | 55 |
| | 18 | 4 | 45 | 4 | 55 | 5 | 06 | 5 | 18 | 5 | 33 | 5 | 53 | 4 | 44 | 5 | 08 | 5 | 38 | 5 | 45 |

The symbol (**) indicates that the phenomenon will occur on the next day

**MOONRISE, 2021**

LOCAL MEAN TIME AND INDIAN STANDARD TIME OF MOONRISE (MOON'S UPPER LIMB)

| | | FOR THE CENTRAL MERIDIAN OF INDIA ( 82º.5 E ) IN L. M. T. | | | | | | | | | | | | FOR CERTAIN STATIONS IN INDIA IN I.S.T. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Lat. | 0º | | 10º | | 20º | | 30º | | 40º | | 50º | | Kolkata | | Chennai | | Delhi | | Mumbai | |
| | | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m |
| Nov. | 18 | 17 | 08 | 16 | 57 | 16 | 44 | 16 | 30 | 16 | 13 | 15 | 50 | 16 | 17 | 17 | 02 | 16 | 54 | 17 | 26 |
| | 19 | 17 | 53 | 17 | 38 | 17 | 22 | 17 | 04 | 16 | 41 | 16 | 10 | 16 | 54 | 17 | 42 | 17 | 28 | 18 | 03 |
| | 20 | 18 | 39 | 18 | 21 | 18 | 03 | 17 | 41 | 17 | 14 | 16 | 36 | 17 | 34 | 18 | 25 | 18 | 06 | 18 | 44 |
| | 21 | 19 | 28 | 19 | 08 | 18 | 47 | 18 | 23 | 17 | 52 | 17 | 08 | 18 | 17 | 19 | 11 | 18 | 48 | 19 | 30 |
| | 22 | 20 | 18 | 19 | 57 | 19 | 35 | 19 | 10 | 18 | 37 | 17 | 50 | 19 | 05 | 20 | 00 | 19 | 35 | 20 | 17 |
| | 23 | 21 | 09 | 20 | 48 | 20 | 26 | 20 | 01 | 19 | 29 | 18 | 41 | 19 | 56 | 20 | 51 | 20 | 26 | 21 | 09 |
| | 24 | 21 | 59 | 21 | 40 | 21 | 20 | 20 | 56 | 20 | 25 | 19 | 42 | 20 | 50 | 21 | 44 | 21 | 21 | 22 | 02 |
| | 25 | 22 | 48 | 22 | 32 | 22 | 14 | 21 | 53 | 21 | 27 | 20 | 50 | 21 | 45 | 22 | 36 | 22 | 18 | 22 | 56 |
| | 26 | 23 | 37 | 23 | 23 | 23 | 08 | 22 | 52 | 22 | 31 | 22 | 02 | 22 | 40 | 23 | 28 | 23 | 16 | 23 | 50 |
| | 27 | ** | ** | ** | ** | ** | ** | 23 | 51 | 23 | 36 | 23 | 16 | 23 | 36 | ** | ** | ** | ** | ** | ** |
| | 28 | 0 | 23 | 0 | 13 | 0 | 03 | ** | ** | ** | ** | ** | ** | ** | ** | 0 | 19 | 0 | 14 | 0 | 44 |
| | 29 | 1 | 09 | 1 | 04 | 0 | 58 | 0 | 51 | 0 | 43 | 0 | 31 | 0 | 32 | 1 | 11 | 1 | 14 | 1 | 39 |
| | 30 | 1 | 56 | 1 | 55 | 1 | 54 | 1 | 53 | 1 | 51 | 1 | 49 | 1 | 29 | 2 | 04 | 2 | 15 | 2 | 34 |
| Dec. | 1 | 2 | 44 | 2 | 48 | 2 | 52 | 2 | 56 | 3 | 02 | 3 | 10 | 2 | 28 | 2 | 58 | 3 | 01 | 3 | 32 |
| | 2 | 3 | 35 | 3 | 44 | 3 | 53 | 4 | 03 | 4 | 16 | 4 | 34 | 3 | 31 | 3 | 56 | 4 | 24 | 4 | 32 |
| | 3 | 4 | 30 | 4 | 44 | 4 | 58 | 5 | 14 | 5 | 35 | 6 | 04 | 4 | 37 | 4 | 57 | 5 | 34 | 5 | 37 |
| | 4 | 5 | 31 | 5 | 48 | 6 | 06 | 6 | 28 | 6 | 55 | 7 | 34 | 5 | 47 | 6 | 03 | 6 | 47 | 6 | 45 |
| | 5 | 6 | 35 | 6 | 55 | 7 | 17 | 7 | 42 | 8 | 13 | 8 | 60 | 6 | 58 | 7 | 11 | 8 | 00 | 7 | 55 |
| | 6 | 7 | 42 | 8 | 02 | 8 | 25 | 8 | 51 | 9 | 24 | 10 | 13 | 8 | 06 | 8 | 18 | 9 | 09 | 9 | 03 |
| | 7 | 8 | 46 | 9 | 06 | 9 | 28 | 9 | 52 | 10 | 23 | 11 | 09 | 9 | 09 | 9 | 22 | 10 | 10 | 10 | 05 |
| | 8 | 9 | 47 | 10 | 04 | 10 | 23 | 10 | 44 | 11 | 11 | 11 | 49 | 10 | 04 | 10 | 19 | 11 | 03 | 11 | 01 |
| | 9 | 10 | 42 | 10 | 56 | 11 | 11 | 11 | 28 | 11 | 49 | 12 | 17 | 10 | 51 | 11 | 10 | 11 | 47 | 11 | 49 |
| | 10 | 11 | 33 | 11 | 42 | 11 | 53 | 12 | 04 | 12 | 19 | 12 | 39 | 11 | 32 | 11 | 55 | 12 | 24 | 12 | 31 |
| | 11 | 12 | 18 | 12 | 24 | 12 | 30 | 12 | 37 | 12 | 45 | 12 | 56 | 12 | 08 | 12 | 35 | 12 | 57 | 13 | 09 |
| | 12 | 13 | 02 | 13 | 03 | 13 | 05 | 13 | 06 | 13 | 09 | 13 | 12 | 12 | 41 | 13 | 13 | 13 | 28 | 13 | 44 |
| | 13 | 13 | 43 | 13 | 41 | 13 | 38 | 13 | 35 | 13 | 31 | 13 | 26 | 13 | 13 | 13 | 49 | 13 | 57 | 14 | 17 |
| | 14 | 14 | 24 | 14 | 18 | 14 | 11 | 14 | 03 | 13 | 54 | 13 | 41 | 13 | 45 | 14 | 25 | 14 | 26 | 14 | 51 |
| | 15 | 15 | 07 | 14 | 56 | 14 | 45 | 14 | 33 | 14 | 17 | 13 | 57 | 14 | 18 | 15 | 02 | 14 | 56 | 15 | 26 |
| | 16 | 15 | 50 | 15 | 37 | 15 | 22 | 15 | 05 | 14 | 44 | 14 | 16 | 14 | 54 | 15 | 41 | 15 | 29 | 16 | 03 |
| | 17 | 16 | 36 | 16 | 19 | 16 | 01 | 15 | 41 | 15 | 15 | 14 | 39 | 15 | 33 | 16 | 23 | 16 | 05 | 16 | 43 |
| | 18 | 17 | 24 | 17 | 05 | 16 | 44 | 16 | 21 | 15 | 52 | 15 | 09 | 16 | 15 | 17 | 08 | 16 | 46 | 17 | 27 |
| | 19 | 18 | 14 | 17 | 54 | 17 | 32 | 17 | 06 | 16 | 34 | 15 | 48 | 17 | 01 | 17 | 56 | 17 | 32 | 18 | 14 |
| | 20 | 19 | 05 | 18 | 44 | 18 | 22 | 17 | 56 | 17 | 24 | 16 | 36 | 17 | 52 | 18 | 47 | 18 | 22 | 19 | 04 |
| | 21 | 19 | 56 | 19 | 36 | 19 | 15 | 18 | 50 | 18 | 19 | 17 | 35 | 18 | 45 | 19 | 39 | 19 | 16 | 19 | 57 |
| | 22 | 20 | 45 | 20 | 28 | 20 | 09 | 19 | 48 | 19 | 20 | 18 | 40 | 19 | 40 | 20 | 31 | 20 | 12 | 20 | 51 |
| | 23 | 21 | 34 | 21 | 19 | 21 | 03 | 20 | 45 | 20 | 22 | 19 | 51 | 20 | 34 | 21 | 24 | 21 | 10 | 21 | 45 |
| | 24 | 22 | 20 | 22 | 09 | 21 | 57 | 21 | 44 | 21 | 27 | 21 | 03 | 21 | 30 | 22 | 14 | 22 | 07 | 22 | 38 |
| | 25 | 23 | 05 | 22 | 58 | 22 | 50 | 22 | 42 | 22 | 31 | 22 | 17 | 22 | 24 | 23 | 05 | 23 | 05 | 23 | 31 |
| | 26 | 23 | 50 | 23 | 47 | 23 | 44 | 23 | 41 | 23 | 37 | 23 | 31 | 23 | 19 | 23 | 55 | ** | ** | ** | ** |
| | 27 | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | 0 | 03 | 0 | 24 |
| | 28 | 0 | 35 | 0 | 37 | 0 | 39 | 0 | 41 | 0 | 44 | 0 | 47 | 0 | 15 | 0 | 47 | 1 | 03 | 1 | 19 |
| | 29 | 1 | 23 | 1 | 30 | 1 | 36 | 1 | 44 | 1 | 54 | 2 | 07 | 1 | 14 | 1 | 41 | 2 | 05 | 2 | 15 |
| | 30 | 2 | 14 | 2 | 25 | 2 | 37 | 2 | 50 | 3 | 07 | 3 | 31 | 2 | 15 | 2 | 38 | 3 | 11 | 3 | 16 |
| | 31 | 3 | 10 | 3 | 26 | 3 | 42 | 4 | 01 | 4 | 24 | 4 | 58 | 3 | 22 | 3 | 40 | 4 | 20 | 4 | 20 |
| | 32 | 4 | 11 | 4 | 30 | 4 | 50 | 5 | 13 | 5 | 43 | 6 | 26 | 4 | 31 | 4 | 45 | 5 | 32 | 5 | 28 |

The symbol (**) indicates that the phenomenon will occur on the next day

**MOONSET, 2021**

LOCAL MEAN TIME AND INDIAN STANDARD TIME OF MOONSET (MOON'S UPPER LIMB)

| | | FOR THE CENTRAL MERIDIAN OF INDIA ( 82º.5 E ) IN L. M. T. | | | | | | | | | | | | FOR CERTAIN STATIONS IN INDIA IN I.S.T. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Lat. | 0º | | 10º | | 20º | | 30º | | 40º | | 50º | | Kolkata | | Chennai | | Delhi | | Mumbai | |
| | | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m | h | m |
| Nov. | 18 | 4 | 45 | 4 | 55 | 5 | 06 | 5 | 18 | 5 | 33 | 5 | 53 | 4 | 44 | 5 | 08 | 5 | 38 | 5 | 45 |
| | 19 | 5 | 29 | 5 | 42 | 5 | 57 | 6 | 13 | 6 | 33 | 7 | 02 | 5 | 36 | 5 | 56 | 6 | 32 | 6 | 35 |
| | 20 | 6 | 14 | 6 | 31 | 6 | 48 | 7 | 09 | 7 | 35 | 8 | 11 | 6 | 29 | 6 | 45 | 7 | 28 | 7 | 27 |
| | 21 | 7 | 02 | 7 | 21 | 7 | 41 | 8 | 04 | 8 | 34 | 9 | 17 | 7 | 23 | 7 | 36 | 8 | 23 | 8 | 19 |
| | 22 | 7 | 52 | 8 | 12 | 8 | 33 | 8 | 59 | 9 | 31 | 10 | 18 | 8 | 15 | 8 | 27 | 9 | 17 | 9 | 11 |
| | 23 | 8 | 42 | 9 | 03 | 9 | 25 | 9 | 51 | 10 | 23 | 11 | 11 | 9 | 07 | 9 | 19 | 10 | 09 | 10 | 03 |
| | 24 | 9 | 33 | 9 | 53 | 10 | 14 | 10 | 38 | 11 | 10 | 11 | 54 | 9 | 56 | 10 | 08 | 10 | 57 | 10 | 52 |
| | 25 | 10 | 23 | 10 | 41 | 10 | 60 | 11 | 22 | 11 | 50 | 12 | 28 | 10 | 41 | 10 | 56 | 11 | 41 | 11 | 38 |
| | 26 | 11 | 12 | 11 | 27 | 11 | 43 | 12 | 01 | 12 | 24 | 12 | 55 | 11 | 23 | 11 | 41 | 12 | 20 | 12 | 20 |
| | 27 | 11 | 59 | 12 | 10 | 12 | 22 | 12 | 36 | 12 | 54 | 13 | 17 | 12 | 02 | 12 | 23 | 12 | 56 | 13 | 01 |
| | 28 | 12 | 45 | 12 | 53 | 13 | 01 | 13 | 10 | 13 | 21 | 13 | 36 | 12 | 39 | 13 | 04 | 13 | 30 | 13 | 40 |
| | 29 | 13 | 32 | 13 | 35 | 13 | 38 | 13 | 42 | 13 | 47 | 13 | 53 | 13 | 15 | 13 | 45 | 14 | 03 | 14 | 17 |
| | 30 | 14 | 18 | 14 | 17 | 14 | 16 | 14 | 14 | 14 | 12 | 14 | 09 | 13 | 52 | 14 | 26 | 14 | 36 | 14 | 56 |
| Dec. | 1 | 15 | 08 | 15 | 02 | 14 | 56 | 14 | 48 | 14 | 39 | 14 | 27 | 14 | 30 | 15 | 09 | 15 | 11 | 15 | 36 |
| | 2 | 16 | 01 | 15 | 51 | 15 | 39 | 15 | 26 | 15 | 10 | 14 | 48 | 15 | 12 | 15 | 56 | 15 | 50 | 16 | 20 |
| | 3 | 16 | 59 | 16 | 44 | 16 | 27 | 16 | 09 | 15 | 46 | 15 | 15 | 15 | 59 | 16 | 48 | 16 | 33 | 17 | 09 |
| | 4 | 18 | 01 | 17 | 43 | 17 | 23 | 16 | 60 | 16 | 31 | 15 | 50 | 16 | 53 | 17 | 46 | 17 | 25 | 18 | 05 |
| | 5 | 19 | 07 | 18 | 46 | 18 | 24 | 17 | 58 | 17 | 26 | 16 | 38 | 17 | 54 | 18 | 49 | 18 | 24 | 19 | 07 |
| | 6 | 20 | 13 | 19 | 52 | 19 | 30 | 19 | 04 | 18 | 31 | 17 | 43 | 18 | 59 | 19 | 55 | 19 | 30 | 20 | 13 |
| | 7 | 21 | 16 | 20 | 57 | 20 | 37 | 20 | 13 | 19 | 43 | 18 | 59 | 20 | 07 | 21 | 00 | 20 | 39 | 21 | 20 |
| | 8 | 22 | 14 | 21 | 58 | 21 | 42 | 21 | 22 | 20 | 57 | 20 | 21 | 21 | 12 | 22 | 03 | 21 | 47 | 22 | 23 |
| | 9 | 23 | 07 | 22 | 55 | 22 | 42 | 22 | 27 | 22 | 09 | 21 | 43 | 22 | 14 | 23 | 00 | 22 | 51 | 23 | 24 |
| | 10 | 23 | 55 | 23 | 47 | 23 | 39 | 23 | 29 | 23 | 17 | 23 | 01 | 23 | 12 | 23 | 54 | 23 | 53 | ** | ** |
| | 11 | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | 0 | 19 |
| | 12 | 0 | 39 | 0 | 35 | 0 | 32 | 0 | 27 | 0 | 22 | 0 | 14 | 0 | 06 | 0 | 44 | 0 | 50 | 1 | 12 |
| | 13 | 1 | 22 | 1 | 22 | 1 | 23 | 1 | 24 | 1 | 24 | 1 | 25 | 0 | 59 | 1 | 32 | 1 | 45 | 2 | 02 |
| | 14 | 2 | 03 | 2 | 07 | 2 | 12 | 2 | 18 | 2 | 25 | 2 | 34 | 1 | 50 | 2 | 18 | 2 | 39 | 2 | 52 |
| | 15 | 2 | 44 | 2 | 53 | 3 | 02 | 3 | 13 | 3 | 26 | 3 | 43 | 2 | 40 | 3 | 05 | 3 | 33 | 3 | 41 |
| | 16 | 3 | 27 | 3 | 39 | 3 | 52 | 4 | 07 | 4 | 26 | 4 | 52 | 3 | 32 | 3 | 52 | 4 | 27 | 4 | 31 |
| | 17 | 4 | 11 | 4 | 27 | 4 | 43 | 5 | 03 | 5 | 27 | 6 | 01 | 4 | 24 | 4 | 41 | 5 | 22 | 5 | 22 |
| | 18 | 4 | 58 | 5 | 17 | 5 | 36 | 5 | 59 | 6 | 27 | 7 | 08 | 5 | 17 | 5 | 32 | 6 | 17 | 6 | 14 |
| | 19 | 5 | 48 | 6 | 07 | 6 | 29 | 6 | 54 | 7 | 25 | 8 | 11 | 6 | 10 | 6 | 23 | 7 | 12 | 7 | 07 |
| | 20 | 6 | 38 | 6 | 59 | 7 | 21 | 7 | 47 | 8 | 19 | 9 | 07 | 7 | 03 | 7 | 15 | 8 | 05 | 7 | 58 |
| | 21 | 7 | 29 | 7 | 49 | 8 | 11 | 8 | 36 | 9 | 08 | 9 | 54 | 7 | 53 | 8 | 05 | 8 | 54 | 8 | 48 |
| | 22 | 8 | 19 | 8 | 38 | 8 | 58 | 9 | 21 | 9 | 50 | 10 | 30 | 8 | 39 | 8 | 53 | 9 | 39 | 9 | 36 |
| | 23 | 9 | 09 | 9 | 25 | 9 | 42 | 10 | 01 | 10 | 25 | 10 | 59 | 9 | 22 | 9 | 39 | 10 | 20 | 10 | 19 |
| | 24 | 9 | 56 | 10 | 08 | 10 | 22 | 10 | 37 | 10 | 56 | 11 | 23 | 10 | 02 | 10 | 21 | 10 | 57 | 11 | 00 |
| | 25 | 10 | 41 | 10 | 50 | 10 | 60 | 11 | 11 | 11 | 24 | 11 | 42 | 10 | 38 | 11 | 02 | 11 | 31 | 11 | 39 |
| | 26 | 11 | 26 | 11 | 31 | 11 | 36 | 11 | 42 | 11 | 49 | 11 | 58 | 11 | 14 | 11 | 42 | 12 | 03 | 12 | 15 |
| | 27 | 12 | 11 | 12 | 11 | 12 | 12 | 12 | 13 | 12 | 13 | 12 | 14 | 11 | 49 | 12 | 21 | 12 | 34 | 12 | 52 |
| | 28 | 12 | 58 | 12 | 54 | 12 | 49 | 12 | 44 | 12 | 38 | 12 | 30 | 12 | 24 | 13 | 02 | 13 | 07 | 13 | 30 |
| | 29 | 13 | 47 | 13 | 39 | 13 | 29 | 13 | 19 | 13 | 06 | 12 | 49 | 13 | 03 | 13 | 45 | 13 | 42 | 14 | 10 |
| | 30 | 14 | 40 | 14 | 27 | 14 | 13 | 13 | 58 | 13 | 38 | 13 | 12 | 13 | 46 | 14 | 32 | 14 | 21 | 14 | 55 |
| | 31 | 15 | 39 | 15 | 22 | 15 | 04 | 14 | 43 | 14 | 17 | 13 | 41 | 14 | 34 | 15 | 26 | 15 | 08 | 15 | 46 |
| | 32 | 16 | 42 | 16 | 22 | 16 | 01 | 15 | 37 | 15 | 06 | 14 | 21 | 15 | 31 | 16 | 25 | 16 | 02 | 16 | 44 |

The symbol (**) indicates that the phenomenon will occur on the next day

**MOONRISE AND MOONSET**
**REDUCTION OF THE L.M.T. OF RISING OR SETTING FOR THE MERIDIAN OF 82°.5 E. LONGITUDE TO THE L.M.T. OF OTHER MERIDIANS**
LONGITUDE EAST OF GREENWICH

| Daily Variation in Rising or Setting | 0° | 30° | 60° | 68° | 72° | 76° | 80° | 84° | 88° | 92° | 96° | 120° | 150° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | m | m | m | m | m | m | m | m | m | m | m | m | m |
| 28 | + 6.4 | + 4.1 | + 1.8 | + 1.1 | + 0.8 | + 0.5 | + 0.2 | - 0.1 | - 0.4 | - 0.7 | - 1.1 | - 2.9 | - 5.3 |
| 29 | 6.6 | 4.2 | 1.8 | 1.2 | 0.8 | 0.5 | 0.2 | 0.1 | 0.4 | 0.8 | 1.1 | 3.0 | 5.4 |
| 30 | 6.9 | 4.4 | 1.9 | 1.2 | 0.9 | 0.5 | 0.2 | 0.1 | 0.5 | 0.8 | 1.1 | 3.1 | 5.6 |
| 31 | 7.1 | 4.5 | 1.9 | 1.2 | 0.9 | 0.6 | 0.2 | 0.1 | 0.5 | 0.8 | 1.2 | 3.2 | 5.8 |
| 32 | 7.3 | 4.7 | 2.0 | 1.3 | 0.9 | 0.6 | 0.2 | 0.1 | 0.5 | 0.8 | 1.2 | 3.3 | 6.0 |
| 33 | 7.6 | 4.8 | 2.1 | 1.3 | 1.0 | 0.6 | 0.2 | 0.1 | 0.5 | 0.9 | 1.2 | 3.4 | 6.2 |
| 34 | 7.8 | 5.0 | 2.1 | 1.4 | 1.0 | 0.6 | 0.2 | 0.1 | 0.5 | 0.9 | 1.3 | 3.5 | 6.4 |
| 35 | 8.0 | 5.1 | 2.2 | 1.4 | 1.0 | 0.6 | 0.2 | 0.1 | 0.5 | 0.9 | 1.3 | 3.6 | 6.6 |
| 36 | 8.2 | 5.2 | 2.3 | 1.4 | 1.0 | 0.6 | 0.2 | 0.1 | 0.5 | 0.9 | 1.4 | 3.7 | 6.8 |
| 37 | 8.5 | 5.4 | 2.3 | 1.5 | 1.1 | 0.7 | 0.3 | 0.2 | 0.6 | 1.0 | 1.4 | 3.9 | 6.9 |
| 38 | 8.7 | 5.5 | 2.4 | 1.5 | 1.1 | 0.7 | 0.3 | 0.2 | 0.6 | 1.0 | 1.4 | 4.0 | 7.1 |
| 39 | 8.9 | 5.7 | 2.4 | 1.6 | 1.1 | 0.7 | 0.3 | 0.2 | 0.6 | 1.0 | 1.5 | 4.1 | 7.3 |
| 40 | + 9.2 | + 5.8 | + 2.5 | + 1.6 | + 1.2 | + 0.7 | + 0.3 | - 0.2 | - 0.6 | - 1.1 | - 1.5 | - 4.2 | - 7.5 |
| 41 | 9.4 | 6.0 | 2.6 | 1.7 | 1.2 | 0.7 | 0.3 | 0.2 | 0.6 | 1.1 | 1.5 | 4.3 | 7.7 |
| 42 | 9.6 | 6.1 | 2.6 | 1.7 | 1.2 | 0.8 | 0.3 | 0.2 | 0.6 | 1.1 | 1.6 | 4.4 | 7.9 |
| 43 | 9.9 | 6.3 | 2.7 | 1.7 | 1.3 | 0.8 | 0.3 | 0.2 | 0.7 | 1.1 | 1.6 | 4.5 | 8.1 |
| 44 | 10.1 | 6.4 | 2.8 | 1.8 | 1.3 | 0.8 | 0.3 | 0.2 | 0.7 | 1.2 | 1.7 | 4.6 | 8.3 |
| 45 | 10.3 | 6.6 | 2.8 | 1.8 | 1.3 | 0.8 | 0.3 | 0.2 | 0.7 | 1.2 | 1.7 | 4.7 | 8.4 |
| 46 | 10.5 | 6.7 | 2.9 | 1.9 | 1.3 | 0.8 | 0.3 | 0.2 | 0.7 | 1.2 | 1.7 | 4.8 | 8.6 |
| 47 | 10.8 | 6.9 | 2.9 | 1.9 | 1.4 | 0.8 | 0.3 | 0.2 | 0.7 | 1.2 | 1.8 | 4.9 | 8.8 |
| 48 | 11.0 | 7.0 | 3.0 | 1.9 | 1.4 | 0.9 | 0.3 | 0.2 | 0.7 | 1.3 | 1.8 | 5.0 | 9.0 |
| 49 | 11.2 | 7.1 | 3.1 | 2.0 | 1.4 | 0.9 | 0.3 | 0.2 | 0.7 | 1.3 | 1.8 | 5.1 | 9.2 |
| 50 | + 11.5 | + 7.3 | + 3.1 | + 2.0 | + 1.5 | + 0.9 | + 0.3 | - 0.2 | - 0.8 | - 1.3 | - 1.9 | - 5.2 | - 9.4 |
| 51 | 11.7 | 7.4 | 3.2 | 2.1 | 1.5 | 0.9 | 0.4 | 0.2 | 0.8 | 1.3 | 1.9 | 5.3 | 9.6 |
| 52 | 11.9 | 7.6 | 3.3 | 2.1 | 1.5 | 0.9 | 0.4 | 0.2 | 0.8 | 1.4 | 2.0 | 5.4 | 9.8 |
| 53 | 12.1 | 7.7 | 3.3 | 2.1 | 1.5 | 1.0 | 0.4 | 0.2 | 0.8 | 1.4 | 2.0 | 5.5 | 9.9 |
| 54 | 12.4 | 7.9 | 3.4 | 2.2 | 1.6 | 1.0 | 0.4 | 0.2 | 0.8 | 1.4 | 2.0 | 5.6 | 10.1 |
| 55 | 12.6 | 8.0 | 3.4 | 2.2 | 1.6 | 1.0 | 0.4 | 0.2 | 0.8 | 1.5 | 2.1 | 5.7 | 10.3 |
| 56 | 12.8 | 8.2 | 3.5 | 2.3 | 1.6 | 1.0 | 0.4 | 0.2 | 0.9 | 1.5 | 2.1 | 5.8 | 10.5 |
| 57 | 13.1 | 8.3 | 3.6 | 2.3 | 1.7 | 1.0 | 0.4 | 0.2 | 0.9 | 1.5 | 2.1 | 5.9 | 10.7 |
| 58 | 13.3 | 8.5 | 3.6 | 2.3 | 1.7 | 1.0 | 0.4 | 0.2 | 0.9 | 1.5 | 2.2 | 6.0 | 10.9 |
| 59 | 13.5 | 8.6 | 3.7 | 2.4 | 1.7 | 1.1 | 0.4 | 0.2 | 0.9 | 1.6 | 2.2 | 6.1 | 11.1 |
| 60 | + 13.7 | + 8.7 | + 3.8 | + 2.4 | + 1.7 | + 1.1 | + 0.4 | - 0.2 | - 0.9 | - 1.6 | - 2.3 | - 6.2 | - 11.3 |
| 61 | 14.0 | 8.9 | 3.8 | 2.5 | 1.8 | 1.1 | 0.4 | 0.3 | 0.9 | 1.6 | 2.3 | 6.4 | 11.4 |
| 62 | 14.2 | 9.0 | 3.9 | 2.5 | 1.8 | 1.1 | 0.4 | 0.3 | 0.9 | 1.6 | 2.3 | 6.5 | 11.6 |
| 63 | 14.4 | 9.2 | 3.9 | 2.5 | 1.8 | 1.1 | 0.4 | 0.3 | 1.0 | 1.7 | 2.4 | 6.6 | 11.8 |
| 64 | 14.7 | 9.3 | 4.0 | 2.6 | 1.9 | 1.2 | 0.4 | 0.3 | 1.0 | 1.7 | 2.4 | 6.7 | 12.0 |
| 65 | 14.9 | 9.5 | 4.1 | 2.6 | 1.9 | 1.2 | 0.5 | 0.3 | 1.0 | 1.7 | 2.4 | 6.8 | 12.2 |
| 66 | 15.1 | 9.6 | 4.1 | 2.7 | 1.9 | 1.2 | 0.5 | 0.3 | 1.0 | 1.7 | 2.5 | 6.9 | 12.4 |
| 67 | 15.4 | 9.8 | 4.2 | 2.7 | 2.0 | 1.2 | 0.5 | 0.3 | 1.0 | 1.8 | 2.5 | 7.0 | 12.6 |
| 68 | 15.6 | 9.9 | 4.3 | 2.7 | 2.0 | 1.2 | 0.5 | 0.3 | 1.0 | 1.8 | 2.6 | 7.1 | 12.8 |
| 69 | 15.8 | 10.1 | 4.3 | 2.8 | 2.0 | 1.2 | 0.5 | 0.3 | 1.1 | 1.8 | 2.6 | 7.2 | 12.9 |
| 70 | + 16.0 | + 10.2 | + 4.4 | + 2.8 | + 2.0 | + 1.3 | + 0.5 | - 0.3 | - 1.1 | - 1.8 | - 2.6 | - 7.3 | - 13.1 |
| 71 | 16.3 | 10.4 | 4.4 | 2.9 | 2.1 | 1.3 | 0.5 | 0.3 | 1.1 | 1.9 | 2.7 | 7.4 | 13.3 |
| 72 | 16.5 | 10.5 | 4.5 | 2.9 | 2.1 | 1.3 | 0.5 | 0.3 | 1.1 | 1.9 | 2.7 | 7.5 | 13.5 |
| 73 | 16.7 | 10.6 | 4.6 | 2.9 | 2.1 | 1.3 | 0.5 | 0.3 | 1.1 | 1.9 | 2.7 | 7.6 | 13.7 |
| 74 | + 17.0 | + 10.8 | + 4.6 | + 3.0 | + 2.2 | + 1.3 | + 0.5 | - 0.3 | - 1.1 | - 2.0 | - 2.8 | - 7.7 | - 13.9 |

## SUNRISE, SUNSET AND MOONRISE, MOONSET
## CORRECTION FOR LATITUDE

VARIATION PER 10° OF LATITUDE OF THE TIMES OF SUNRISE, SUNSET AND MOONRISE, MOONSET DISTRIBUTED OVER EACH DEGREE OF LATITUDE

| Var. per 10° of Lat. | 1° | 2° | 3° | 4° | 5° | 6° | 7° | 8° | 9° | 10° | 15' | 30' | 45' |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | m | m | m | m | m | m | m | m | m | m | m | m | m |
| 5 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | 0.1 | 0.3 | 0.4 |
| 6 | 0.6 | 1.2 | 1.8 | 2.4 | 3.0 | 3.6 | 4.2 | 4.8 | 5.4 | 6.0 | 0.2 | 0.3 | 0.5 |
| 7 | 0.7 | 1.4 | 2.1 | 2.8 | 3.5 | 4.2 | 4.9 | 5.6 | 6.3 | 7.0 | 0.2 | 0.4 | 0.5 |
| 8 | 0.8 | 1.6 | 2.4 | 3.2 | 4.0 | 4.8 | 5.6 | 6.4 | 7.2 | 8.0 | 0.2 | 0.4 | 0.6 |
| 9 | 0.9 | 1.8 | 2.7 | 3.6 | 4.5 | 5.4 | 6.3 | 7.2 | 8.1 | 9.0 | 0.2 | 0.5 | 0.7 |
| 10 | 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | 6.0 | 7.0 | 8.0 | 9.0 | 10.0 | 0.3 | 0.5 | 0.8 |
| 11 | 1.1 | 2.2 | 3.3 | 4.4 | 5.5 | 6.6 | 7.7 | 8.8 | 9.9 | 11.0 | 0.3 | 0.6 | 0.8 |
| 12 | 1.2 | 2.4 | 3.6 | 4.8 | 6.0 | 7.2 | 8.4 | 9.6 | 10.8 | 12.0 | 0.3 | 0.6 | 0.9 |
| 13 | 1.3 | 2.6 | 3.9 | 5.2 | 6.5 | 7.8 | 9.1 | 10.4 | 11.7 | 13.0 | 0.3 | 0.7 | 1.0 |
| 14 | 1.4 | 2.8 | 4.2 | 5.6 | 7.0 | 8.4 | 9.8 | 11.2 | 12.6 | 14.0 | 0.4 | 0.7 | 1.1 |
| 15 | 1.5 | 3.0 | 4.5 | 6.0 | 7.5 | 9.0 | 10.5 | 12.0 | 13.5 | 15.0 | 0.4 | 0.8 | 1.1 |
| 16 | 1.6 | 3.2 | 4.8 | 6.4 | 8.0 | 9.6 | 11.2 | 12.8 | 14.4 | 16.0 | 0.4 | 0.8 | 1.2 |
| 17 | 1.7 | 3.4 | 5.1 | 6.8 | 8.5 | 10.2 | 11.9 | 13.6 | 15.3 | 17.0 | 0.4 | 0.9 | 1.3 |
| 18 | 1.8 | 3.6 | 5.4 | 7.2 | 9.0 | 10.8 | 12.6 | 14.4 | 16.2 | 18.0 | 0.5 | 0.9 | 1.4 |
| 19 | 1.9 | 3.8 | 5.7 | 7.6 | 9.5 | 11.4 | 13.3 | 15.2 | 17.1 | 19.0 | 0.5 | 1.0 | 1.4 |
| 20 | 2.0 | 4.0 | 6.0 | 8.0 | 10.0 | 12.0 | 14.0 | 16.0 | 18.0 | 20.0 | 0.5 | 1.0 | 1.5 |
| 21 | 2.1 | 4.2 | 6.3 | 8.4 | 10.5 | 12.6 | 14.7 | 16.8 | 18.9 | 21.0 | 0.5 | 1.1 | 1.6 |
| 22 | 2.2 | 4.4 | 6.6 | 8.8 | 11.0 | 13.2 | 15.4 | 17.6 | 19.8 | 22.0 | 0.6 | 1.1 | 1.7 |
| 23 | 2.3 | 4.6 | 6.9 | 9.2 | 11.5 | 13.8 | 16.1 | 18.4 | 20.7 | 23.0 | 0.6 | 1.2 | 1.7 |
| 24 | 2.4 | 4.8 | 7.2 | 9.6 | 12.0 | 14.4 | 16.8 | 19.2 | 21.6 | 24.0 | 0.6 | 1.2 | 1.8 |
| 25 | 2.5 | 5.0 | 7.5 | 10.0 | 12.5 | 15.0 | 17.5 | 20.0 | 22.5 | 25.0 | 0.6 | 1.3 | 1.9 |
| 26 | 2.6 | 5.2 | 7.8 | 10.4 | 13.0 | 15.6 | 18.2 | 20.8 | 23.4 | 26.0 | 0.7 | 1.3 | 2.0 |
| 27 | 2.7 | 5.4 | 8.1 | 10.8 | 13.5 | 16.2 | 18.9 | 21.6 | 24.3 | 27.0 | 0.7 | 1.4 | 2.0 |
| 28 | 2.8 | 5.6 | 8.4 | 11.2 | 14.0 | 16.8 | 19.6 | 22.4 | 25.2 | 28.0 | 0.7 | 1.4 | 2.1 |
| 29 | 2.9 | 5.8 | 8.7 | 11.6 | 14.5 | 17.4 | 20.3 | 23.2 | 26.1 | 29.0 | 0.7 | 1.5 | 2.2 |
| 30 | 3.0 | 6.0 | 9.0 | 12.0 | 15.0 | 18.0 | 21.0 | 24.0 | 27.0 | 30.0 | 0.8 | 1.5 | 2.3 |
| 31 | 3.1 | 6.2 | 9.3 | 12.4 | 15.5 | 18.6 | 21.7 | 24.8 | 27.9 | 31.0 | 0.8 | 1.6 | 2.3 |
| 32 | 3.2 | 6.4 | 9.6 | 12.8 | 16.0 | 19.2 | 22.4 | 25.6 | 28.8 | 32.0 | 0.8 | 1.6 | 2.4 |
| 33 | 3.3 | 6.6 | 9.9 | 13.2 | 16.5 | 19.8 | 23.1 | 26.4 | 29.7 | 33.0 | 0.8 | 1.7 | 2.5 |
| 34 | 3.4 | 6.8 | 10.2 | 13.6 | 17.0 | 20.4 | 23.8 | 27.2 | 30.6 | 34.0 | 0.9 | 1.7 | 2.6 |
| 35 | 3.5 | 7.0 | 10.5 | 14.0 | 17.5 | 21.0 | 24.5 | 28.0 | 31.5 | 35.0 | 0.9 | 1.8 | 2.6 |
| 36 | 3.6 | 7.2 | 10.8 | 14.4 | 18.0 | 21.6 | 25.2 | 28.8 | 32.4 | 36.0 | 0.9 | 1.8 | 2.7 |
| 37 | 3.7 | 7.4 | 11.1 | 14.8 | 18.5 | 22.2 | 25.9 | 29.6 | 33.3 | 37.0 | 0.9 | 1.9 | 2.8 |
| 38 | 3.8 | 7.6 | 11.4 | 15.2 | 19.0 | 22.8 | 26.6 | 30.4 | 34.2 | 38.0 | 1.0 | 1.9 | 2.9 |
| 39 | 3.9 | 7.8 | 11.7 | 15.6 | 19.5 | 23.4 | 27.3 | 31.2 | 35.1 | 39.0 | 1.0 | 2.0 | 2.9 |
| 40 | 4.0 | 8.0 | 12.0 | 16.0 | 20.0 | 24.0 | 28.0 | 32.0 | 36.0 | 40.0 | 1.0 | 2.0 | 3.0 |
| 41 | 4.1 | 8.2 | 12.3 | 16.4 | 20.5 | 24.6 | 28.7 | 32.8 | 36.9 | 41.0 | 1.0 | 2.1 | 3.1 |
| 42 | 4.2 | 8.4 | 12.6 | 16.8 | 21.0 | 25.2 | 29.4 | 33.6 | 37.8 | 42.0 | 1.1 | 2.1 | 3.2 |
| 43 | 4.3 | 8.6 | 12.9 | 17.2 | 21.5 | 25.8 | 30.1 | 34.4 | 38.7 | 43.0 | 1.1 | 2.2 | 3.2 |
| 44 | 4.4 | 8.8 | 13.2 | 17.6 | 22.0 | 26.4 | 30.8 | 35.2 | 39.6 | 44.0 | 1.1 | 2.2 | 3.3 |
| 45 | 4.5 | 9.0 | 13.5 | 18.0 | 22.5 | 27.0 | 31.5 | 36.0 | 40.5 | 45.0 | 1.1 | 2.3 | 3.4 |
| 46 | 4.6 | 9.2 | 13.8 | 18.4 | 23.0 | 27.6 | 32.2 | 36.8 | 41.4 | 46.0 | 1.2 | 2.3 | 3.5 |
| 47 | 4.7 | 9.4 | 14.1 | 18.8 | 23.5 | 28.2 | 32.9 | 37.6 | 42.3 | 47.0 | 1.2 | 2.4 | 3.5 |
| 48 | 4.8 | 9.6 | 14.4 | 19.2 | 24.0 | 28.8 | 33.6 | 38.4 | 43.2 | 48.0 | 1.2 | 2.4 | 3.6 |
| 49 | 4.9 | 9.8 | 14.7 | 19.6 | 24.5 | 29.4 | 34.3 | 39.2 | 44.1 | 49.0 | 1.2 | 2.5 | 3.7 |
| 50 | 5.0 | 10.0 | 15.0 | 20.0 | 25.0 | 30.0 | 35.0 | 40.0 | 45.0 | 50.0 | 1.3 | 2.5 | 3.8 |

# REDUCTION OF TIME

## REDUCTION OF LOCAL MEAN TIME OF A PLACE INTO THE INDIAN STANDARD TIME

A-CORRECTION TO BE ADDED TO L.M.T. TO OBTAIN I.S.T.

| | LONGITUDE OF PLACE (EAST OF GREENWICH) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 67° | 68° | 69° | 70° | 71° | 72° | 73° | 74° | 75° | 76° | 77° | 78° | 79° | 80° | 81° | 82° |
| | m | m | m | m | m | m | m | m | m | m | m | m | m | m | m | m |
| 0 | 62.0 | 58.0 | 54.0 | 50.0 | 46.0 | 42.0 | 38.0 | 34.0 | 30.0 | 26.0 | 22.0 | 18.0 | 14.0 | 10.0 | 6.0 | 2.0 |
| 3 | 61.8 | 57.8 | 53.8 | 49.8 | 45.8 | 41.8 | 37.8 | 33.8 | 29.8 | 25.8 | 21.8 | 17.8 | 13.8 | 9.8 | 5.8 | 1.8 |
| 6 | 61.6 | 57.6 | 53.6 | 49.6 | 45.6 | 41.6 | 37.6 | 33.6 | 29.6 | 25.6 | 21.6 | 17.6 | 13.6 | 9.6 | 5.6 | 1.6 |
| 9 | 61.4 | 57.4 | 53.4 | 49.4 | 45.4 | 41.4 | 37.4 | 33.4 | 29.4 | 25.4 | 21.4 | 17.4 | 13.4 | 9.4 | 5.4 | 1.4 |
| 12 | 61.2 | 57.2 | 53.2 | 49.2 | 45.2 | 41.2 | 37.2 | 33.2 | 29.2 | 25.2 | 21.2 | 17.2 | 13.2 | 9.2 | 5.2 | 1.2 |
| 15 | 61.0 | 57.0 | 53.0 | 49.0 | 45.0 | 41.0 | 37.0 | 33.0 | 29.0 | 25.0 | 21.0 | 17.0 | 13.0 | 9.0 | 5.0 | 1.0 |
| 18 | 60.8 | 56.8 | 52.8 | 48.8 | 44.8 | 40.8 | 36.8 | 32.8 | 28.8 | 24.8 | 20.8 | 16.8 | 12.8 | 8.8 | 4.8 | 0.8 |
| 21 | 60.6 | 56.6 | 52.6 | 48.6 | 44.6 | 40.6 | 36.6 | 32.6 | 28.6 | 24.6 | 20.6 | 16.6 | 12.6 | 8.6 | 4.6 | 0.6 |
| 24 | 60.4 | 56.4 | 52.4 | 48.4 | 44.4 | 40.4 | 36.4 | 32.4 | 28.4 | 24.4 | 20.4 | 16.4 | 12.4 | 8.4 | 4.4 | 0.4 |
| 27 | 60.2 | 56.2 | 52.2 | 48.2 | 44.2 | 40.2 | 36.2 | 32.2 | 28.2 | 24.2 | 20.2 | 16.2 | 12.2 | 8.2 | 4.2 | 0.2 |
| 30 | 60.0 | 56.0 | 52.0 | 48.0 | 44.0 | 40.0 | 36.0 | 32.0 | 28.0 | 24.0 | 20.0 | 16.0 | 12.0 | 8.0 | 4.0 | 0.0 |
| 33 | 59.8 | 55.8 | 51.8 | 47.8 | 43.8 | 39.8 | 35.8 | 31.8 | 27.8 | 23.8 | 19.8 | 15.8 | 11.8 | 7.8 | 3.8 | |
| 36 | 59.6 | 55.6 | 51.6 | 47.6 | 43.6 | 39.6 | 35.6 | 31.6 | 27.6 | 23.6 | 19.6 | 15.6 | 11.6 | 7.6 | 3.6 | |
| 39 | 59.4 | 55.4 | 51.4 | 47.4 | 43.4 | 39.4 | 35.4 | 31.4 | 27.4 | 23.4 | 19.4 | 15.4 | 11.4 | 7.4 | 3.4 | |
| 42 | 59.2 | 55.2 | 51.2 | 47.2 | 43.2 | 39.2 | 35.2 | 31.2 | 27.2 | 23.2 | 19.2 | 15.2 | 11.2 | 7.2 | 3.2 | |
| 45 | 59.0 | 55.0 | 51.0 | 47.0 | 43.0 | 39.0 | 35.0 | 31.0 | 27.0 | 23.0 | 19.0 | 15.0 | 11.0 | 7.0 | 3.0 | |
| 48 | 58.8 | 54.8 | 50.8 | 46.8 | 42.8 | 38.8 | 34.8 | 30.8 | 26.8 | 22.8 | 18.8 | 14.8 | 10.8 | 6.8 | 2.8 | |
| 51 | 58.6 | 54.6 | 50.6 | 46.6 | 42.6 | 38.6 | 34.6 | 30.6 | 26.6 | 22.6 | 18.6 | 14.6 | 10.6 | 6.6 | 2.6 | |
| 54 | 58.4 | 54.4 | 50.4 | 46.4 | 42.4 | 38.4 | 34.4 | 30.4 | 26.4 | 22.4 | 18.4 | 14.4 | 10.4 | 6.4 | 2.4 | |
| 57 | 58.2 | 54.2 | 50.2 | 46.2 | 42.2 | 38.2 | 34.2 | 30.2 | 26.2 | 22.2 | 18.2 | 14.2 | 10.2 | 6.2 | 2.2 | |
| 60 | 58.0 | 54.0 | 50.0 | 46.0 | 42.0 | 38.0 | 34.0 | 30.0 | 26.0 | 22.0 | 18.0 | 14.0 | 10.0 | 6.0 | 2.0 | |

B- CORRECTION TO BE SUBTRACTED FROM L.M.T. TO OBTAIN I.S.T.

| | LONGITUDE OF PLACE (EAST OF GREENWICH) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 82° | 83° | 84° | 85° | 86° | 87° | 88° | 89° | 90° | 91° | 92° | 93° | 94° | 95° | 96° | 97° |
| | m | m | m | m | m | m | m | m | m | m | m | m | m | m | m | m |
| 0 | | 2.0 | 6.0 | 10.0 | 14.0 | 18.0 | 22.0 | 26.0 | 30.0 | 34.0 | 38.0 | 42.0 | 46.0 | 50.0 | 54.0 | 58.0 |
| 3 | | 2.2 | 6.2 | 10.2 | 14.2 | 18.2 | 22.2 | 26.2 | 30.2 | 34.2 | 38.2 | 42.2 | 46.2 | 50.2 | 54.2 | 58.2 |
| 6 | | 2.4 | 6.4 | 10.4 | 14.4 | 18.4 | 22.4 | 26.4 | 30.4 | 34.4 | 38.4 | 42.4 | 46.4 | 50.4 | 54.4 | 58.4 |
| 9 | | 2.6 | 6.6 | 10.6 | 14.6 | 18.6 | 22.6 | 26.6 | 30.6 | 34.6 | 38.6 | 42.6 | 46.6 | 50.6 | 54.6 | 58.6 |
| 12 | | 2.8 | 6.8 | 10.8 | 14.8 | 18.8 | 22.8 | 26.8 | 30.8 | 34.8 | 38.8 | 42.8 | 46.8 | 50.8 | 54.8 | 58.8 |
| 15 | | 3.0 | 7.0 | 11.0 | 15.0 | 19.0 | 23.0 | 27.0 | 31.0 | 35.0 | 39.0 | 43.0 | 47.0 | 51.0 | 55.0 | 59.0 |
| 18 | | 3.2 | 7.2 | 11.2 | 15.2 | 19.2 | 23.2 | 27.2 | 31.2 | 35.2 | 39.2 | 43.2 | 47.2 | 51.2 | 55.2 | 59.2 |
| 21 | | 3.4 | 7.4 | 11.4 | 15.4 | 19.4 | 23.4 | 27.4 | 31.4 | 35.4 | 39.4 | 43.4 | 47.4 | 51.4 | 55.4 | 59.4 |
| 24 | | 3.6 | 7.6 | 11.6 | 15.6 | 19.6 | 23.6 | 27.6 | 31.6 | 35.6 | 39.6 | 43.6 | 47.6 | 51.6 | 55.6 | 59.6 |
| 27 | | 3.8 | 7.8 | 11.8 | 15.8 | 19.8 | 23.8 | 27.8 | 31.8 | 35.8 | 39.8 | 43.8 | 47.8 | 51.8 | 55.8 | 59.8 |
| 30 | 0.0 | 4.0 | 8.0 | 12.0 | 16.0 | 20.0 | 24.0 | 28.0 | 32.0 | 36.0 | 40.0 | 44.0 | 48.0 | 52.0 | 56.0 | 60.0 |
| 33 | 0.2 | 4.2 | 8.2 | 12.2 | 16.2 | 20.2 | 24.2 | 28.2 | 32.2 | 36.2 | 40.2 | 44.2 | 48.2 | 52.2 | 56.2 | 60.2 |
| 36 | 0.4 | 4.4 | 8.4 | 12.4 | 16.4 | 20.4 | 24.4 | 28.4 | 32.4 | 36.4 | 40.4 | 44.4 | 48.4 | 52.4 | 56.4 | 60.4 |
| 39 | 0.6 | 4.6 | 8.6 | 12.6 | 16.6 | 20.6 | 24.6 | 28.6 | 32.6 | 36.6 | 40.6 | 44.6 | 48.6 | 52.6 | 56.6 | 60.6 |
| 42 | 0.8 | 4.8 | 8.8 | 12.8 | 16.8 | 20.8 | 24.8 | 28.8 | 32.8 | 36.8 | 40.8 | 44.8 | 48.8 | 52.8 | 56.8 | 60.8 |
| 45 | 1.0 | 5.0 | 9.0 | 13.0 | 17.0 | 21.0 | 25.0 | 29.0 | 33.0 | 37.0 | 41.0 | 45.0 | 49.0 | 53.0 | 57.0 | 61.0 |
| 48 | 1.2 | 5.2 | 9.2 | 13.2 | 17.2 | 21.2 | 25.2 | 29.2 | 33.2 | 37.2 | 41.2 | 45.2 | 49.2 | 53.2 | 57.2 | 61.2 |
| 51 | 1.4 | 5.4 | 9.4 | 13.4 | 17.4 | 21.4 | 25.4 | 29.4 | 33.4 | 37.4 | 41.4 | 45.4 | 49.4 | 53.4 | 57.4 | 61.4 |
| 54 | 1.6 | 5.6 | 9.6 | 13.6 | 17.6 | 21.6 | 25.6 | 29.6 | 33.6 | 37.6 | 41.6 | 45.6 | 49.6 | 53.6 | 57.6 | 61.6 |
| 57 | 1.8 | 5.8 | 9.8 | 13.8 | 17.8 | 21.8 | 25.8 | 29.8 | 33.8 | 37.8 | 41.8 | 45.8 | 49.8 | 53.8 | 57.8 | 61.8 |
| 60 | 2.0 | 6.0 | 10.0 | 14.0 | 18.0 | 22.0 | 26.0 | 30.0 | 34.0 | 38.0 | 42.0 | 46.0 | 50.0 | 54.0 | 58.0 | 62.0 |

Sunrise and Sunset

The local mean times of Sunrise and Sunset for latitudes 0° to 60° North at intervals of 4 days during the year have been given on pages 280 to 287. The timings relate to the visibility of the upper limb of the Sun on the horizon. From these tables the L.M.T. of rise or set for any day of the year and for any latitude of place can be obtained by simple interpolation. If the place is in the southern hemisphere, the corrections given on pages 290 to 291 will then have to be applied to the timings for the corresponding northern latitude. For a station in India, the timings of Sunrise and Sunset so obtained which are in L.M.T. can be reduced to I.S.T. by applying the correction given on page 314 according to the longitude of the station.

In addition to the above details given in the publication, the timings of Sunrise and Sunset of five important cities of India, viz., Kolkata, Varanasi, Chennai, Delhi and Mumbai have been specially calculated and given in I.S.T. on pages 292 to 295.

Sunrise and Sunset for Southern Latitudes

The timings of Sunrise and Sunset for southern latitudes, which have not been tabulated separately, can be deduced from those for the corresponding northern latitudes by applying the corrections given on pages 290 and 291.

Twilight

The timings of the beginning of morning twilight and ending of evening twilight have been given for latitudes 0° to 60° North on pages 280 to 287. The timings relate to the instant when the center of the Sun is 18° below the horizon. This is now known as astronomical twilight. The period of twilight has been divided into three parts - Civil when the Sun is 6° below the horizon, Nautical when 12° and Astronomical when 18° - and their durations have been given separately on pages 288 and 289 at an interval of 8 days. The figures for any intermediate date can be worked out from the tables by simple interpolation.

Moonrise and Moonset

The local mean times of Moonrise and Moonset for latitudes 0° to 50° North at 10- degrees interval together with the timings of these events in I.S.T. for four important stations in India, Viz., Kolkata, Chennai, Delhi and Mumbai for each day of the year have been given on pages 296 to 311 along with some supplementary tables on pages 312 to 313. A detailed method of calculation for any station is given below.

To find the time of Moonrise and Moonset for any station the figure for the phenomena concerned given against the date is to be taken from the table (pages 296 to 311) for the latitude just lower than the latitude of the station, to which the following corrections will have to be applied :

(a) Correction for difference in latitude;
(b) Correction for longitude, if the place is not on the Central Meridian of India (i.e., 82°.5 E. Long);
(c) Correction for converting L.M.T. into I.S.T., when and where necessary.

These corrections are detailed below :

(a) Correction for difference in latitude - The timings of Moonrise and Moonset have been given for latitudes 0°, 10°, 20°, 30°, 40° and 50° North, and in local mean time. The timing for any particular latitude of place falling within the above limits can be obtained by simple interpolation between figures for the two latitudes, one below and the other above the latitude of the given place. For this purpose the table on page 313 can be conveniently used wherein corrections for latitude are shown according to the variation per 10° of latitude of the timings of Moonrise or Moonset distributed over each degree of latitude. The correction can also be calculated directly by multiplying one-tenth of the time difference between the figures for two consecutive given latitudes by the excess of the latitude of the station over the given lower latitude.

(b) Correction for difference in longitude - The timings thus obtained are exact for the Central Meridian of India, i.e, for longitude $82^\circ.5$ East of Greenwich. For other longitudes the correction given on page 312 should be applied according to :

(i) the longitude of the station, and
(ii) the daily variation of the timings of rising or setting, as the case may be, between two consecutive dates.

If greater accuracy is not required, the daily variation may be assumed to be a constant (i.e., 50 minutes) for all dates and corrections from the following table may be applied instead of taking the corrections from the table on page 312.

| Longitude of Station (East) | Correction m | Longitude of Station (East) | Correction m |
|---|---|---|---|
| $0^\circ$ | + 11.5 | $84^\circ$ | - 0.2 |
| $30^\circ$ | + 7.3 | $88^\circ$ | - 0.8 |
| $60^\circ$ | + 3.1 | $92^\circ$ | - 1.3 |
| $68^\circ$ | + 2.0 | $96^\circ$ | - 1.9 |
| $72^\circ$ | + 1.5 | $120^\circ$ | - 5.2 |
| $76^\circ$ | + 0.9 | $150^\circ$ | - 9.4 |
| $80^\circ$ | + 0.3 | $180^\circ$ | - 13.5 |

The timing thus obtained by the above two operations is in L.M.T. of the station

(c) Correction for converting L.M.T. into I.S.T. - The figures obtained by the operations (a) and (b) above would give the local mean time of Moonrise or Moonset for the given station. The local mean time can be reduced to the Indian Standard Time by the help of the reduction table on page 314. In other way to obtain the I.S.T., the L.M.T. may be increased at the rate of 4 minutes per degree of longitude if the station is to the west of $82^\circ.5$ East and decreased at the same rate if the station is to the east of $82^\circ.5$ East Longitude.

In practice, however, when dealing with the same station, it will be convenient to combine corrections (b) and (c) above, as these are constant day after day, and add this constant to the daily times corrected for latitude only.

Moonrise and Moonset for southern Latitudes

The times of Moonrise and Moonset for southern latitudes have not been given separately. The timings for a station in southern latitude can, however, be deduced from those for the corresponding northern latitude by the following formula :

Timings for a southern latitude = 2 $\times$ Timing for $0^\circ$ latitude - Timing for the same northern latitude.

In this case the local mean time for the same latitude north will have to be calculated first by applying the latitude correction (a) above, and the corresponding time for the southern latitude will have to be deduced by the above formula by utilising the published figure for $0^\circ$ latitude. The exact L.M.T. of rising or setting for the place in question will, however, be obtained by applying the correction (b) above to the time so deduced.

If necessary, the timings thus obtained may be reduced to I.S.T. by the usual method.

**PHASES OF THE MOON, 2021**

( Time in I.S.T. )

| | | d | h | m | | | d | h | m |
|---|---|---|---|---|---|---|---|---|---|
| New Moon | Dec, 20 | 14 | 21 | 47 | New Moon | Jul | 10 | 6 | 47 |
| First Quarter | Dec, 20 | 22 | 5 | 11 | First Quarter | Jul | 17 | 15 | 41 |
| Full Moon | Dec, 20 | 30 | 8 | 58 | Full Moon | Jul | 24 | 8 | 7 |
| Last Quarter | Jan, 21 | 6 | 15 | 7 | Last Quarter | Jul | 31 | 18 | 46 |
| New Moon | Jan | 13 | 10 | 30 | New Moon | Aug | 8 | 19 | 20 |
| First Quarter | Jan | 21 | 2 | 32 | First Quarter | Aug | 15 | 20 | 50 |
| Full Moon | Jan | 29 | 0 | 46 | Full Moon | Aug | 22 | 17 | 32 |
| Last Quarter | Feb | 4 | 23 | 7 | Last Quarter | Aug | 30 | 12 | 43 |
| New Moon | Feb | 12 | 0 | 36 | New Moon | Sep | 7 | 6 | 22 |
| First Quarter | Feb | 20 | 0 | 17 | First Quarter | Sep | 14 | 2 | 9 |
| Full Moon | Feb | 27 | 13 | 47 | Full Moon | Sep | 21 | 5 | 25 |
| Last Quarter | Mar | 6 | 7 | 0 | Last Quarter | Sep | 29 | 7 | 27 |
| New Moon | Mar | 13 | 15 | 51 | New Moon | Oct | 6 | 16 | 35 |
| First Quarter | Mar | 21 | 20 | 10 | First Quarter | Oct | 13 | 8 | 55 |
| Full Moon | Mar | 29 | 0 | 18 | Full Moon | Oct | 20 | 20 | 27 |
| Last Quarter | Apr | 4 | 15 | 32 | Last Quarter | Oct | 29 | 1 | 35 |
| New Moon | Apr | 12 | 8 | 1 | New Moon | Nov | 5 | 2 | 45 |
| First Quarter | Apr | 20 | 12 | 29 | First Quarter | Nov | 11 | 18 | 16 |
| Full Moon | Apr | 27 | 9 | 1 | Full Moon | Nov | 19 | 14 | 27 |
| Last Quarter | May | 4 | 1 | 20 | Last Quarter | Nov | 27 | 17 | 58 |
| New Moon | May | 12 | 0 | 30 | New Moon | Dec | 4 | 13 | 13 |
| First Quarter | May | 20 | 0 | 43 | First Quarter | Dec | 11 | 7 | 6 |
| Full Moon | May | 26 | 16 | 44 | Full Moon | Dec | 19 | 10 | 5 |
| Last Quarter | Jun | 2 | 12 | 54 | Last Quarter | Dec | 27 | 7 | 54 |
| New Moon | Jun | 10 | 16 | 23 | New Moon | Jan, 22 | 3 | 0 | 3 |
| First Quarter | Jun | 18 | 9 | 24 | First Quarter | Jan, 22 | 9 | 23 | 41 |
| Full Moon | Jun | 25 | 0 | 10 | Full Moon | Jan, 22 | 18 | 5 | 18 |
| Last Quarter | Jul | 2 | 2 | 41 | Last Quarter | Jan, 22 | 25 | 19 | 11 |

# PART - IV

## ECLIPSES AND OCCULTATIONS

## ECLIPSES, 2021

In the year 2021, there are twoeclipses of the Sunand two eclipse of the Moon.

| | | | | |
|---|---|---|---|---|
| I | May | 26 | Total Lunar eclipse | 328–329 |
| II | June | 10 | Annular Solar eclipse | 320–323 |
| III | November | 19 | Partial Lunar eclipse | 330 |
| IV | December | 4 | Total Solar eclipse | 324–327 |

II-Annular Eclipse of the Sun, June 10, 2021, Thursday

**Not Visible in India**

**Area of Visibility**

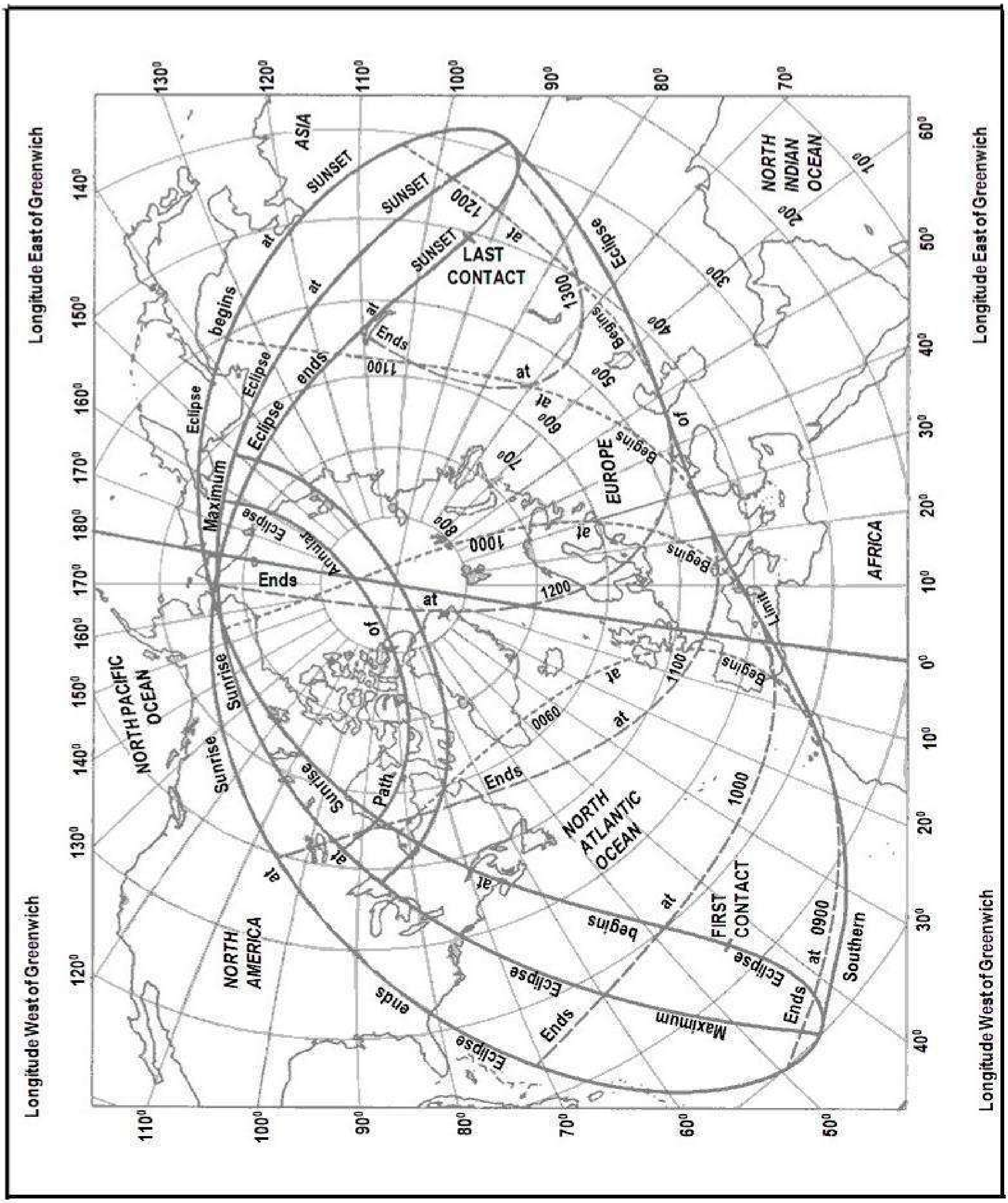
The eclipse is visible in the region covering north eastern North America, Europe, northern Asia and the North Atlantic Ocean.

| ELEMENTS OF THE ECLIPSE | | | | | | |
|---|---|---|---|---|---|---|
| Universal Time of Conjunction in Right Ascension :June10$^{d}$11$^{h}$01$^{m}$ 04$^{s}$.13 | | | | | | |
| | | | | | | |
| | MOON | | | SUN | | |
| | h | m | s | h | m | s |
| Right Ascension | 5 | 15 | 34.68 | 5 | 15 | 34.68 |
| Hourly Motion | | | 129.08 | | | 10.36 |
| | | | | | | |
| | | | | | | |
| Declination | 23 | 52 | 57.34 | 23 | 02 | 40.64 |
| Hourly Motion | | 04 | 56.57 | | | 10.97 |
| Equatorial Horizontal Parallax | | 54 | 14.63 | | | 08.66 |
| True Semi-diameter | | 14 | 46.53 | | 15 | 45.17 |

| CIRCUMSTANCES OF THE ECLIPSE | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | Universal Time | | | Indian Standard Time | | | Latitude | | Longitude | |
| | d | h | m | d | h | m | ° | ' | ° | ' |
| Eclipse begins | 10 | 08 | 12.5 | 10 | 13 | 42.5 | 23 | 40.0 | -43 | 59.4 |
| Central eclipse begins | 10 | 09 | 55.0 | 10 | 15 | 25.0 | 50 | 10.2 | -89 | 31.8 |
| Greatest eclipse* | 10 | 10 | 41.9 | 10 | 16 | 11.9 | 80 | 48.8 | -66 | 25.1 |
| Central eclipse ends | 10 | 11 | 28.7 | 10 | 16 | 58.7 | 63 | 34.4 | +156 | 33.8 |
| Eclipse ends | 10 | 13 | 11.2 | 10 | 18 | 41.2 | 41 | 28.8 | +94 | 09.8 |

*Magnitude of the eclipse = 0.943, Maximum duration of Annular phase =3 m 48s.

# ANNULAR SOLAR ECLIPSE OF JUNE 10, 2021




The timings of beginning and ending are expressed in UT

# ECLIPSES, 2021

BESSELIAN ELEMENTS OF THE ANNULAR ECLIPSE OF THE SUN
JUNE10

| Terrestrial Time (TT) | | Co-ordinates of the Centre of Shadow on the Fundamental Plane | | Direction of the Axis of Shadow * | | | | | Radius of Penumbra and Umbra on the Fundamental Plane | |
|---|---|---|---|---|---|---|---|---|---|---|
| h | m | x | y | sin d | cos d | μ ° | ' | " | $l_1$ | $l_2$ |
| 8 | 00 | -1.521931 | +0.658186 | +0.391273 | +0.920275 | 300 | 07 | 45.4 | +0.563493 | +0.018472 |
| | 10 | -1.438451 | +0.673152 | +0.391280 | +0.920272 | 302 | 37 | 44.9 | +0.563493 | +0.018472 |
| | 20 | -1.354966 | +0.688108 | +0.391288 | +0.920268 | 305 | 07 | 44.4 | +0.563493 | +0.018472 |
| | 30 | -1.271477 | +0.703055 | +0.391296 | +0.920265 | 307 | 37 | 44.0 | +0.563492 | +0.018471 |
| | 40 | -1.187984 | +0.717992 | +0.391303 | +0.920262 | 310 | 07 | 43.5 | +0.563491 | +0.018470 |
| | 50 | -1.104487 | +0.732920 | +0.391311 | +0.920258 | 312 | 37 | 43.0 | +0.563489 | +0.018468 |
| 9 | 00 | -1.020986 | +0.747839 | +0.391319 | +0.920255 | 315 | 07 | 42.5 | +0.563486 | +0.018465 |
| | 10 | -0.937482 | +0.762748 | +0.391326 | +0.920252 | 317 | 37 | 42.0 | +0.563483 | +0.018462 |
| | 20 | -0.853974 | +0.777647 | +0.391334 | +0.920249 | 320 | 07 | 41.6 | +0.563480 | +0.018459 |
| | 30 | -0.770463 | +0.792537 | +0.391342 | +0.920245 | 322 | 37 | 41.1 | +0.563476 | +0.018455 |
| | 40 | -0.686949 | +0.807417 | +0.391349 | +0.920242 | 325 | 07 | 40.6 | +0.563471 | +0.018450 |
| | 50 | -0.603431 | +0.822287 | +0.391357 | +0.920239 | 327 | 37 | 40.1 | +0.563466 | +0.018445 |
| 10 | 00 | -0.519911 | +0.837147 | +0.391364 | +0.920236 | 330 | 07 | 39.6 | +0.563461 | +0.018440 |
| | 10 | -0.436389 | +0.851998 | +0.391372 | +0.920233 | 332 | 37 | 39.2 | +0.563455 | +0.018434 |
| | 20 | -0.352864 | +0.866839 | +0.391380 | +0.920229 | 335 | 07 | 38.7 | +0.563448 | +0.018427 |
| | 30 | -0.269337 | +0.881671 | +0.391387 | +0.920226 | 337 | 37 | 38.2 | +0.563441 | +0.018420 |
| | 40 | -0.185808 | +0.896492 | +0.391395 | +0.920223 | 340 | 07 | 37.7 | +0.563433 | +0.018412 |
| | 50 | -0.102277 | +0.911304 | +0.391403 | +0.920220 | 342 | 37 | 37.3 | +0.563425 | +0.018404 |
| 11 | 00 | -0.018744 | +0.926105 | +0.391410 | +0.920216 | 345 | 07 | 36.8 | +0.563416 | +0.018395 |
| | 10 | +0.064790 | +0.940897 | +0.391418 | +0.920213 | 347 | 37 | 36.3 | +0.563407 | +0.018386 |
| | 20 | +0.148326 | +0.955679 | +0.391425 | +0.920210 | 350 | 07 | 35.8 | +0.563397 | +0.018376 |
| | 30 | +0.231863 | +0.970450 | +0.391433 | +0.920207 | 352 | 37 | 35.3 | +0.563387 | +0.018366 |
| | 40 | +0.315401 | +0.985212 | +0.391440 | +0.920204 | 355 | 07 | 34.9 | +0.563376 | +0.018355 |
| | 50 | +0.398939 | +0.999964 | +0.391448 | +0.920200 | 357 | 37 | 34.4 | +0.563365 | +0.018344 |
| 12 | 00 | +0.482478 | +1.014705 | +0.391455 | +0.920197 | 360 | 07 | 33.9 | +0.563353 | +0.018332 |
| | 10 | +0.566018 | +1.029437 | +0.391463 | +0.920194 | 362 | 37 | 33.4 | +0.563341 | +0.018320 |
| | 20 | +0.649558 | +1.044158 | +0.391471 | +0.920191 | 365 | 07 | 33.0 | +0.563328 | +0.018307 |
| | 30 | +0.733098 | +1.058869 | +0.391478 | +0.920187 | 367 | 37 | 32.5 | +0.563315 | +0.018294 |
| | 40 | +0.816638 | +1.073570 | +0.391486 | +0.920184 | 370 | 07 | 32.0 | +0.563301 | +0.018280 |
| | 50 | +0.900178 | +1.088261 | +0.391493 | +0.920181 | 372 | 37 | 31.5 | +0.563287 | +0.018266 |
| 13 | 00 | +0.983717 | +1.102941 | +0.391501 | +0.920178 | 375 | 07 | 31.0 | +0.563272 | +0.018251 |
| | 10 | +1.067256 | +1.117612 | +0.391508 | +0.920175 | 377 | 37 | 30.6 | +0.563257 | +0.018236 |
| | 20 | +1.150794 | +1.132271 | +0.391516 | +0.920172 | 380 | 07 | 30.1 | +0.563241 | +0.018220 |
| | 30 | +1.234331 | +1.146921 | +0.391523 | +0.920168 | 382 | 37 | 29.6 | +0.563225 | +0.018204 |
| | 40 | +1.317867 | +1.161560 | +0.391531 | +0.920165 | 385 | 07 | 29.1 | +0.563208 | +0.018187 |
| | 50 | +1.401402 | +1.176188 | +0.391538 | +0.920162 | 387 | 37 | 28.7 | +0.563191 | +0.018170 |
| 14 | 00 | +1.484935 | +1.190806 | +0.391546 | +0.920159 | 390 | 07 | 28.2 | +0.563174 | +0.018153 |

tanf1= 0.00461340 tanf2= 0.00459045

| TT | d | | | Variations per minute | | | |
|---|---|---|---|---|---|---|---|
| hr | ° | ' | " | x' | y' | μ' ' | " |
| 8 | 23 | 02 | 01 | +0.008 348 | +0.001 497 | 15 | 00 |
| 9 | 23 | 02 | 12 | +0.008 350 | +0.001 491 | 15 | 00 |
| 10 | 23 | 02 | 22 | +0.008 352 | +0.001 485 | 15 | 00 |
| 11 | 23 | 02 | 32 | +0.008 353 | +0.001 479 | 15 | 00 |
| 12 | 23 | 02 | 41 | +0.008 354 | +0.001 473 | 15 | 00 |
| 13 | 23 | 02 | 53 | +0.008 354 | +0.001 467 | 15 | 00 |

$\xi' = 0.004364\rho\cos\phi'\cos(\mu+\lambda)$ $\eta' = 0.004364\xi\sin d$

*d stands for declination and μ stands for hour angle

**ECLIPSES, 2021**

PATH OF CENTRAL PHASE DURING THE ANNULAR ECLIPSE OF THE SUN
JUNE 10

| Terrestrial Time (TT) | Northern Limit | | | | Central Line | | | | Southern Limit | | | | Central Line |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Latitude | | Longitude | | Latitude | | Longitude | | Latitude | | Longitude | | Duration of Annularity |
| | ° | ' | ° | ' | ° | ' | ° | ' | ° | ' | ° | ' | m s |
| Limit | +52 | 18.7 | -93 | 36.6 | +50 | 10.2 | -89 | 31.5 | +48 | 11.6 | -86 | 04.0 | ------ |
| h m | | | | | | | | | | | | | |
| 10 10 | +63 | 19.3 | -79 | 42.9 | +64 | 28.7 | -71 | 40.5 | +65 | 02.1 | -64 | 48.7 | 3 44 |
| 20 | 69 | 21.7 | 76 | 31.4 | 69 | 57.9 | 68 | 13.6 | 70 | 08.9 | 60 | 49.5 | 3 46 |
| 30 | 74 | 37.9 | 76 | 22.4 | 74 | 59.9 | 66 | 20.4 | 74 | 56.7 | 57 | 19.8 | 3 47 |
| 40 | 79 | 33.0 | 80 | 35.2 | 79 | 52.2 | 66 | 22.0 | 79 | 38.0 | 53 | 40.3 | 3 48 |
| 50 | +83 | 58.8 | -97 | 54.9 | +84 | 42.5 | -72 | 21.6 | +84 | 21.6 | -48 | 21.3 | 3 47 |
| 11 00 | +85 | 31.8 | -156 | 48.9 | +88 | 18.0 | -147 | 32.0 | +89 | 06.3 | -10 | 14.7 | 3 46 |
| 10 | 81 | 06.4 | +164 | 29.6 | 83 | 47.1 | +149 | 02.2 | 85 | 17.0 | +124 | 13.7 | 3 45 |
| 20 | +72 | 36.4 | +158 | 26.2 | +76 | 50.5 | +146 | 04.2 | +79 | 06.3 | +132 | 27.0 | 3 41 |
| Limit | +64 | 46.0 | +163 | 32.5 | +63 | 34.4 | +156 | 33.8 | +62 | 19.6 | +150 | 43.3 | ------- |

## ECLIPSES, 2021

IV-Total Eclipse of the Sun, December 4, 2021, Saturday

**Not visible in India**

**Area of Visibility**

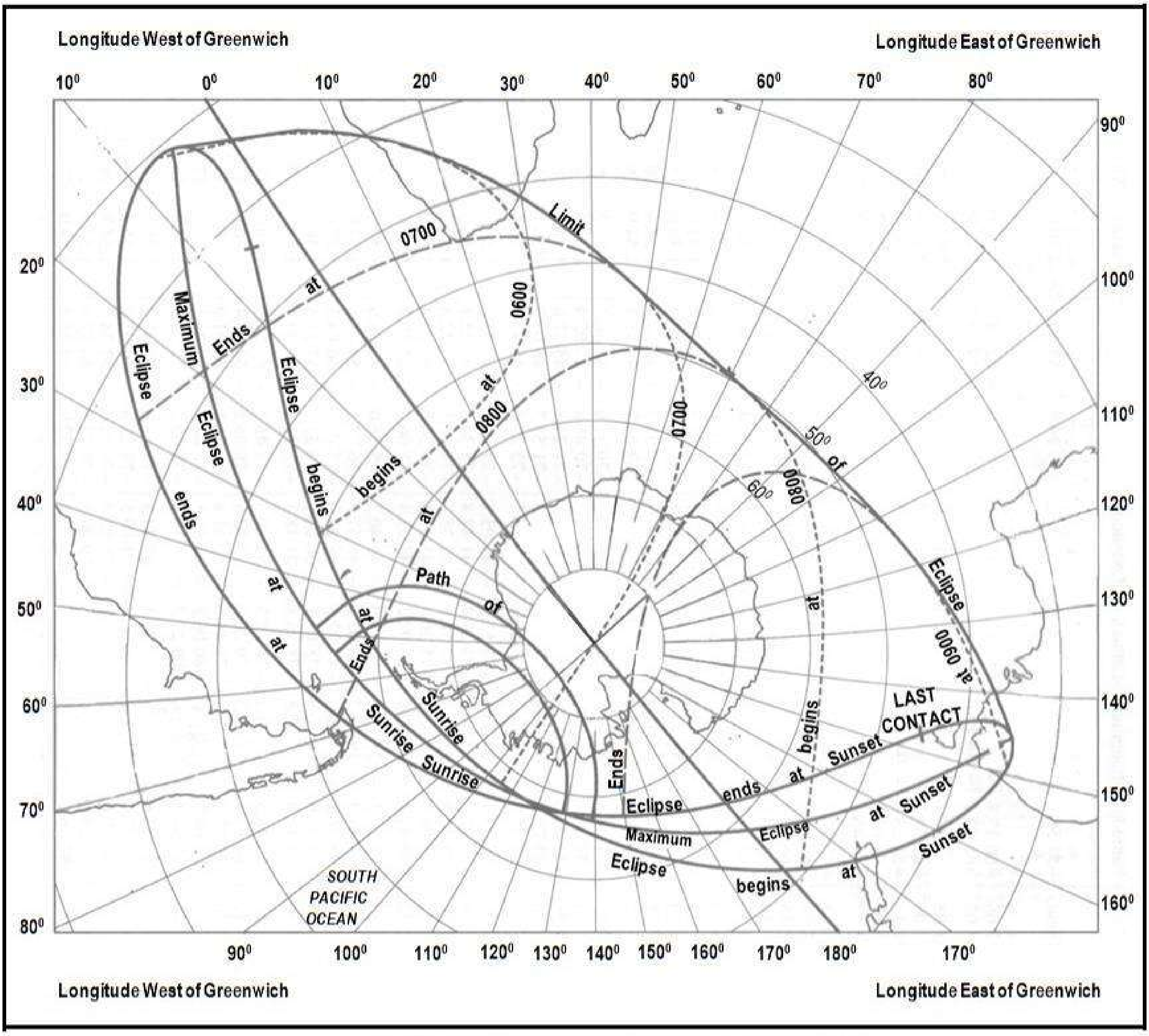
The eclipse is visible in the region covering Antarctica, extreme South Africa, extreme South Australia, the South Atlantic Ocean and the south Indian Ocean.

| ELEMENTS OF THE ECLIPSE | | | | | | |
|---|---|---|---|---|---|---|
| Universal Time of Conjunction in Right Ascension :December $4^d7^h56^m10^s.00$ | | | | | | |
| | | | | | | |
| | MOON | | | SUN | | |
| | h | m | s | h | m | s |
| Right Ascension | 16 | 43 | 36.54 | 16 | 43 | 36.55 |
| Hourly Motion | | | 162.42 | | | 10.87 |
| | | | | | | |
| | | | | | | |
| Declination | -23 | 16 | 33.46 | -22 | 16 | 36.87 |
| Hourly Motion | | -08 | 28.53 | | | -19.84 |
| Equatorial Horizontal Parallax | | 61 | 27.36 | | | 08.92 |
| True Semi-diameter | | 16 | 44.38 | | 16 | 13.62 |

| CIRCUMSTANCES OF THE ECLIPSE | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | Universal Time | | | Indian Standard Time | | | Latitude | | Longitude | |
| | d | h | m | d | h | m | ° | ' | ° | ' |
| Eclipse begins | 4 | 05 | 29.4 | 4 | 10 | 59 | -23 | 20.7 | 04 | 59.0 |
| Central eclipse begins | 4 | 07 | 02.9 | 4 | 12 | 33 | -53 | 05.0 | 51 | 12.4 |
| Greatest eclipse* | 4 | 07 | 33.5 | 4 | 13 | 04 | -76 | 46.6 | 45 | 59.6 |
| Central eclipse ends | 4 | 08 | 03.8 | 4 | 13 | 34 | -67 | 21.9 | -134 | 11.0 |
| Eclipse ends | 4 | 09 | 37.4 | 4 | 15 | 07 | -46 | 24.9 | +148 | 42.7 |

* Magnitude of the eclipse = 1.036, Maximum duration of totality = 1 m 57s.

# TOTAL SOLAR ECLIPSE OF 2021 DECEMBER 4




The timings of beginning and ending are expressed in UT

# ECLIPSES, 2021

## BESSELIAN ELEMENTS OF THE TOTAL ECLIPSE OF THE SUN DECEMBER 4

| Terrestrial Time (TT) | | Co-ordinates of the Centre of Shadow on the Fundamental Plane | | Direction of the Axis of Shadow * | | | | | Radius of Penumbra and Umbra on the Fundamental Plane | |
|---|---|---|---|---|---|---|---|---|---|---|
| h | m | x | y | sin d | cos d | μ ° | ' | " | $l_1$ | $l_2$ |
| 5 | 00 | -1.679095 | -0.587191 | -0.378796 | +0.925480 | 257 | 27 | 37.1 | +0.536861 | -0.008160 |
| | 10 | -1.584458 | -0.609315 | -0.378810 | +0.925474 | 259 | 57 | 35.5 | +0.536871 | -0.008150 |
| | 20 | -1.489814 | -0.631427 | -0.378824 | +0.925469 | 262 | 27 | 33.8 | +0.536880 | -0.008141 |
| | 30 | -1.395164 | -0.653528 | -0.378838 | +0.925463 | 264 | 57 | 32.2 | +0.536889 | -0.008133 |
| | 40 | -1.300508 | -0.675618 | -0.378852 | +0.925457 | 267 | 27 | 30.6 | +0.536897 | -0.008125 |
| | 50 | -1.205846 | -0.697696 | -0.378866 | +0.925451 | 269 | 57 | 29.0 | +0.536904 | -0.008118 |
| 6 | 00 | -1.111178 | -0.719763 | -0.378880 | +0.925446 | 272 | 27 | 27.3 | +0.536910 | -0.008111 |
| | 10 | -1.016505 | -0.741818 | -0.378894 | +0.925440 | 274 | 57 | 25.7 | +0.536916 | -0.008106 |
| | 20 | -0.921827 | -0.763862 | -0.378908 | +0.925434 | 277 | 27 | 24.1 | +0.536921 | -0.008101 |
| | 30 | -0.827144 | -0.785894 | -0.378922 | +0.925429 | 279 | 57 | 22.4 | +0.536925 | -0.008097 |
| | 40 | -0.732456 | -0.807914 | -0.378936 | +0.925423 | 282 | 27 | 20.8 | +0.536928 | -0.008093 |
| | 50 | -0.637764 | -0.829923 | -0.378950 | +0.925417 | 284 | 57 | 19.2 | +0.536931 | -0.008091 |
| 7 | 00 | -0.543067 | -0.851919 | -0.378964 | +0.925411 | 287 | 27 | 17.5 | +0.536932 | -0.008089 |
| | 10 | -0.448368 | -0.873904 | -0.378978 | +0.925406 | 289 | 57 | 15.9 | +0.536934 | -0.008088 |
| | 20 | -0.353664 | -0.895877 | -0.378992 | +0.925400 | 292 | 27 | 14.3 | +0.536934 | -0.008087 |
| | 30 | -0.258958 | -0.917837 | -0.379006 | +0.925394 | 294 | 57 | 12.7 | +0.536934 | -0.008088 |
| | 40 | -0.164248 | -0.939786 | -0.379020 | +0.925388 | 297 | 27 | 11.0 | +0.536933 | -0.008089 |
| | 50 | -0.069536 | -0.961722 | -0.379034 | +0.925383 | 299 | 57 | 09.4 | +0.536931 | -0.008091 |
| 8 | 00 | +0.025179 | -0.983646 | -0.379048 | +0.925377 | 302 | 27 | 07.8 | +0.536928 | -0.008093 |
| | 10 | +0.119896 | -1.005558 | -0.379062 | +0.925371 | 304 | 57 | 06.1 | +0.536925 | -0.008096 |
| | 20 | +0.214615 | -1.027457 | -0.379076 | +0.925366 | 307 | 27 | 04.5 | +0.536921 | -0.008101 |
| | 30 | +0.309335 | -1.049344 | -0.379090 | +0.925360 | 309 | 57 | 02.8 | +0.536916 | -0.008105 |
| | 40 | +0.404057 | -1.071218 | -0.379104 | +0.925354 | 312 | 27 | 01.2 | +0.536910 | -0.008111 |
| | 50 | +0.498779 | -1.093080 | -0.379118 | +0.925349 | 314 | 56 | 59.6 | +0.536904 | -0.008117 |
| 9 | 00 | +0.593503 | -1.114929 | -0.379132 | +0.925343 | 317 | 26 | 57.9 | +0.536897 | -0.008124 |
| | 10 | +0.688227 | -1.136765 | -0.379146 | +0.925337 | 319 | 56 | 56.3 | +0.536889 | -0.008132 |
| | 20 | +0.782951 | -1.158588 | -0.379159 | +0.925331 | 322 | 26 | 54.7 | +0.536881 | -0.008141 |
| | 30 | +0.877675 | -1.180399 | -0.379173 | +0.925326 | 324 | 56 | 53.0 | +0.536872 | -0.008150 |
| | 40 | +0.972399 | -1.202197 | -0.379187 | +0.925320 | 327 | 26 | 51.4 | +0.536862 | -0.008160 |
| | 50 | +1.067122 | -1.223981 | -0.379201 | +0.925314 | 329 | 56 | 49.8 | +0.536851 | -0.008171 |
| 10 | 00 | +1.161845 | -1.245753 | -0.379215 | +0.925309 | 332 | 26 | 48.1 | +0.536839 | -0.008182 |
| | 10 | +1.256566 | -1.267511 | -0.379229 | +0.925303 | 334 | 56 | 46.5 | +0.536827 | -0.008194 |
| | 20 | +1.351286 | -1.289256 | -0.379243 | +0.925297 | 337 | 26 | 44.8 | +0.536814 | -0.008207 |
| | 30 | +1.446004 | -1.310988 | -0.379257 | +0.925292 | 339 | 56 | 43.2 | +0.536800 | -0.008221 |
| | 40 | +1.540721 | -1.332707 | -0.379271 | +0.925286 | 342 | 26 | 41.6 | +0.536786 | -0.008235 |
| | 50 | +1.635435 | -1.354412 | -0.379285 | +0.925280 | 344 | 56 | 39.9 | +0.536771 | -0.008251 |
| 11 | 00 | +1.730146 | -1.376104 | -0.379298 | +0.925274 | 347 | 26 | 38.3 | +0.536755 | -0.008267 |

$\tan f1 = 0.00475106$ $\tan f2 = 0.00472743$

| TT hr | d ° | ' | " | Variations per minute x' | y' | μ' ' | " |
|---|---|---|---|---|---|---|---|
| 5 | -22 | 15 | 33 | +0.009 464 | -0.002 212 | 15 | 00 |
| 6 | -22 | 15 | 52 | +0.009 467 | -0.002 206 | 15 | 00 |
| 7 | -22 | 16 | 10 | +0.009 470 | -0.002 199 | 15 | 00 |
| 8 | -22 | 16 | 29 | +0.009 472 | -0.002 191 | 15 | 00 |
| 9 | -22 | 16 | 48 | +0.009 472 | -0.002 184 | 15 | 00 |
| 10 | -22 | 17 | 06 | +0.009 472 | -0.002 176 | 15 | 00 |

$\xi' = 0.004364\rho\cos\phi'\cos(\mu+\lambda)$ $\eta' = 0.004364\xi\sin d$

*d stands for declination and μ stands for hour angle

## ECLIPSES, 2021

PATH OF CENTRAL PHASE DURING THE TOTAL ECLIPSE OF THE SUN
DECEMBER 4

| Terrestrial Time (TT) | Northern Limit | | Central Line | | Southern Limit | | Central Line |
|---|---|---|---|---|---|---|---|
| | Latitude | Longitude | Latitude | Longitude | Latitude | Longitude | Duration of totality |
| | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' | m s |
| Limit | -51 50.8 | -48 54.2 | -53 05.0 | -51 12.1 | -54 24.9 | -53 50.4 | ------- |
| h m | | | | | | | |
| 7 10 | -63 20.3 | -34 54.2 | -62 22.6 | -39 50.2 | -60 58.0 | -45 23.0 | 1 42 |
| 20 | 69 49.9 | 32 57.9 | 69 13.5 | 38 10.0 | 68 23.1 | 43 30.5 | 1 49 |
| 30 | 75 34.2 | 35 58.4 | 74 58.8 | 42 35.5 | 74 09.0 | 49 06.0 | 1 52 |
| 40 | 80 40.3 | 49 24.3 | 79 44.5 | 58 30.7 | 78 30.5 | 66 32.3 | 1 51 |
| 50 | -83 15.0 | -91 25.1 | -81 22.9 | -97 07.4 | -79 14.2 | -101 12.6 | 1 47 |
| 8 00 | -78 41.7 | -133 37.3 | -75 46.2 | -130 56.2 | -71 16.4 | -128 40.0 | 1 38 |
| Limit | -67 02.5 | -138 50.8 | -67 21.9 | -134 10.4 | -67 36.2 | -128 55.9 | ------- |

## ECLIPSES, 2021

I- Total Eclipse of the Moon, May 26, 2021, Wednesday

**Visible in India**

Eclipse will be visible in the region covering South America, North America, Asia, Australia, Antarctica, the Pacific Ocean and the Indian Ocean.

The places from where the beginning of the umbral phase is visible at the time of moonset are western parts of Brazil, eastern parts of USA and Canada.

The places from where the ending of the umbral phase is visible at the time of moonrise are the Indian Ocean, Sri Lanka, north eastern parts of India, China, Mongolia and Russia.

In India, just after moonrise, ending of partial phase of the eclipse will be visible for a short span of time from north eastern parts of India except Sikkim, some parts of West Bengal and some costal parts of Odisha.

| ELEMENTS OF THE ECLIPSE | | | | | | |
|---|---|---|---|---|---|---|
| Universal Time of Opposition in Right Ascension : May$26^d 11^h 04^m 44^s 79$ | | | | | | |
| | | | | | | |
| | MOON | | | SUN | | |
| | h | m | s | h | m | s |
| Right Ascension | 16 | 14 | 01.22 | 04 | 14 | 01.23 |
| Hourly Motion | | | 157.22 | | | 10.13 |
| | | | | | | |
| | ° | ' | " | ° | ' | " |
| Declination | -20 | 41 | 52.60 | 21 | 12 | 18.92 |
| Hourly Motion | | -10 | 07.27 | | | 25.52 |
| Equatorial Horizontal Parallax | | 61 | 20.61 | | | 08.68 |
| True Semi-diameter | | 16 | 42.54 | | 15 | 47.27 |

| CIRCUMSTANCES OF THE ECLIPSE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Indian Standard Time | | | Position Angle measured from the North Point of Moon's Limb (N.E.S.W.) | The Moon being in the Zenith in | | | |
| | | | | | | | | Latitude | | Longitude | |
| | d | h | m | d | h | m | ° | ° | ' | ° | ' |
| Moon enters penumbra | 26 | 08 | 46.1 | 26 | 14 | 16.1 | 124 | -20 | 18 | -133 | 23 |
| Moon enters umbra | 26 | 09 | 44.6 | 26 | 15 | 14.6 | 133 | -20 | 28 | -147 | 24 |
| Moon enters Totality | 26 | 11 | 09.4 | 26 | 16 | 39.4 | 05 | -20 | 43 | -167 | 44 |
| Middle of the eclipse* | 26 | 11 | 18.7 | 26 | 16 | 48.7 | 16 | -20 | 44 | -169 | 58 |
| Moon leaves Totality | 26 | 11 | 28.0 | 26 | 16 | 58.0 | 27 | -20 | 46 | -172 | 12 |
| Moon leaves umbra | 26 | 12 | 52.8 | 26 | 18 | 22.8 | 258 | -21 | 00 | +167 | 28 |
| Moon leaves penumbra | 26 | 13 | 51.3 | 26 | 19 | 21.3 | 268 | -21 | 10 | +153 | 27 |

*Magnitude of the eclipse =1.016 (Moon's diam =1.0). Distance between the centers at middle 1756''.4

Radius of shadow cone at Moon's distance: Penumbra 4722".6, Umbra 2790''.2

EASTERN AND WESTERN LIMITS OF VISIBILITY

| Eastern Limit Moonset at beginning (09h 44.6m U.T.) | | | | | | Western Limit Moonrise at ending (12h 52.8m U.T.) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Latitude | Longitude | | Latitude | Longitude | | Latitude | Longitude | | Latitude | Longitude | |
| | ° | ' | ° | ° | ' | ° | ° | ' | ° | ° | ' |
| -50 | -30 | 59 | +10 | -61 | 10 | -50 | +50 | 15 | +10 | +81 | 21 |
| 40 | 39 | 09 | 20 | 65 | 12 | 40 | 58 | 41 | 20 | 85 | 30 |
| 30 | 44 | 57 | 30 | 69 | 51 | 30 | 64 | 40 | 30 | 90 | 16 |
| 20 | 49 | 35 | 40 | 75 | 39 | 20 | 69 | 26 | 40 | 96 | 15 |
| -10 | 53 | 37 | 50 | 83 | 49 | -10 | 73 | 35 | 50 | 104 | 41 |
| 0 | -57 | 24 | +60 | -97 | 41 | 0 | +77 | 28 | +60 | +119 | 08 |

The eclipse is visible in the region west of the eastern limit and east of the western limit. Here, moonset and moonrise times relate to visibility of the center of the Moon on the horizon.

## ECLIPSES, 2021

PHASES OF ECLIPSE VISIBLE FROM CERTAIN PLACES OF INDIA
MAY 26

| PLACES | Moon Rise ( IST) | Umbral phase begins at 15h 15m (IST) | Totality begins at 16 h 39m (IST) | Greatest Phase at 16h 49m (IST) | Totality Ends at 16h 58m (IST) | Umbral phase Ends at 18 h 23m ( IST) |
|---|---|---|---|---|---|---|
| | h m | Visibility | | | | |
| Agartala | 18 06 | * | * | * | * | Visible |
| Aizawl | 17 59 | * | * | * | * | Visible |
| Kolkata | 18 15 | * | * | * | * | Visible |
| Cherrapunji | 18 06 | * | * | * | * | Visible |
| Cooch Behar | 18 18 | * | * | * | * | Visible |
| Dhaka | 18 09 | * | * | * | * | Visible |
| Diamond Harbour | 18 15 | * | * | * | * | Visible |
| Digha | 18 16 | * | * | * | * | Visible |
| Guwahati | 18 09 | * | * | * | * | Visible |
| Imphal | 17 56 | * | * | * | * | Visible |
| Itanagar | 18 02 | * | * | * | * | Visible |
| Kohima | 17 57 | * | * | * | * | Visible |
| Lumding | 18 01 | * | * | * | * | Visible |
| Malda | 18 21 | * | * | * | * | Visible |
| North Lakhimpur | 18 00 | * | * | * | * | Visible |
| Paradeep | 18 18 | * | * | * | * | Visible |
| Pashighat | 17 57 | * | * | * | * | Visible |
| Port Blair | 17 38 | * | * | * | * | Visible |
| Puri | 18 21 | * | * | * | * | Visible |
| Shillong | 18 06 | * | * | * | * | Visible |
| Sibsagar | 17 58 | * | * | * | * | Visible |
| Silchar | 18 01 | * | * | * | * | Visible |

* Indicates Moon rises after the corresponding phenomenon (i.e. corresponding phenomeno*n is not visible)*

# ECLIPSES, 2021

III- Partial Eclipse of the Moon, November 19, 2021, Friday
**Visible in India**

The Eclipse will be visible in the region covering western Africa, western Europe, North America, South America, Asia, Australasia, the Atlantic Ocean and the Pacific Ocean.

The places from where the beginning of the umbral phase is visible at the time of moonset are South America, North Atlantic Ocean and United Kingdom,

The place from where the ending of the umbral phase is visible at the time of moonrise are Australia, Indonesia, Thailand, extreme north eastern parts of India, China and Russia.

In India, just after moonrise, ending of partial phase of the eclipse will be visible for a very short span of time from extreme north eastern parts Arunachal Pradesh and Assam.

| ELEMENTS OF THE ECLIPSE | | | | | | |
|---|---|---|---|---|---|---|
| Universal Time of Opposition in Right Ascension : November $19^{d}8^{h}44^{m}16^{s}.18$ | | | | | | |
| | | | | | | |
| | MOON | | | SUN | | |
| | h | m | s | h | m | s |
| Right Ascension | 3 | 39 | 47.61 | 15 | 39 | 47.63 |
| Hourly Motion | | | 119.44 | | | 10.42 |
| | | | | | | |
| | ° | ' | " | ° | ' | " |
| Declination | 19 | 06 | 19.19 | -19 | 32 | 21.63 |
| Hourly Motion | | 09 | 27.42 | | | -34.56 |
| Equatorial Horizontal Parallax | | 54 | 06.17 | | | 08.90 |
| True Semi-diameter | | 14 | 44.22 | | 16 | 11.05 |

| CIRCUMSTANCES OF THE ECLIPSE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Universal Time | | | Indian Standard Time | | | Position Angle measured from the North Point of Moon's Limb (N.E.S.W.) | The Moon being in the Zenith in | | | |
| | | | | | | | | Latitude | | Longitude | |
| | d | h | m | d | h | m | ° | ° | ' | ° | ' |
| Moon enters penumbra | 19 | 06 | 00.2 | 19 | 11 | 30.2 | 54 | +18 | 40 | -94 | 40 |
| Moon enters umbra | 19 | 07 | 18.3 | 19 | 12 | 48.3 | 35 | +18 | 53 | -113 | 36 |
| Middle of the eclipse* | 19 | 09 | 02.9 | 19 | 14 | 32.9 | 341 | +19 | 09 | -138 | 56 |
| Moon leaves umbra | 19 | 10 | 47.4 | 19 | 16 | 17.4 | 278 | +19 | 26 | -164 | 17 |
| Moon leaves penumbra | 19 | 12 | 05.5 | 19 | 17 | 35.5 | 268 | +19 | 38 | +176 | 48 |

*Magnitude of the eclipse =0.979 (Moon's diam =1.0). Distance between the centers at middle 1477".0

Radius of shadow cone at Moon's distance: Penumbra 4304".7, Umbra 2323".7

EASTERN AND WESTERN LIMITS OF VISIBILITY

| Eastern Limit Moonset at beginning (07h 18.3m U.T.) | | | | | | Western Limit Moonrise at ending (10h 47.4m U.T.) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Latitude | Longitude | | Latitude | Longitude | | Latitude | Longitude | | Latitude | Longitude | |
| | ° | ′ | ° | ° | ′ | ° | ° | ′ | ° | ° | ′ |
| -50 | -47 | 39 | +10 | -20 | 08 | -50 | +130 | 34 | +10 | +102 | 09 |
| 40 | 40 | 16 | 20 | 16 | 27 | 40 | 122 | 56 | 20 | 98 | 21 |
| 30 | 34 | 59 | 30 | 12 | 12 | 30 | 117 | 28 | 30 | 93 | 58 |
| 20 | 30 | 45 | 40 | -6 | 55 | 20 | 113 | 06 | 40 | 88 | 30 |
| -10 | 27 | 03 | 50 | 0 | 27 | -10 | 109 | 17 | 50 | 80 | 52 |
| 0 | -23 | 36 | +60 | +12 | 44 | 0 | +105 | 43 | +60 | +68 | 04 |

The eclipse is visible in the region west of the eastern limit and east of the western limit. Here, moonset and moonrise times relate to visibility of the center of the Moon on the horizon.

**OCCULTATIONS, 2021**

PLANETS BY THE MOON

| Sl. No. | Date and Ingress - Egress Times (U.T.) | | Planet | Magnitude of Planet | Area of Visibility |
|---|---|---|---|---|---|
| | | h -- h | | | |
| 1. | Apr – 17 | 09.8 – 14.6 | Mars | 1.4 | Most of central and eastern Africa, southern parts of the Middle East, India, South East Asia, Indonesia, most of the Philippines. |
| 2. | May – 12 | 20.4 – 24.6 | Venus | -3.9 | Most of New Zealand, eastern Polynesia, Easter Island. |
| 3. | Nov – 03 | 18.5 – 20.8 | Mercury | -0.8 | Canada (except westernmost), north eastern USA, Bermuda. |
| 4. | Nov – 08 | 04.4 – 06.6 | Venus | -4.7 | North eastern Mongolia, north eastern China, south eastern Russia, Japan (except southernmost parts), western Aleutian Islands. |
| 5. | Dec – 03 | -01.0 – 02.7 | Mars | 1.6 | Most of Mongolia, north eastern China, parts of eastern Russia, Japan, most of Micronesia, northernmost Polynesia, Hawaii. |
| 6. | Dec – 31 | 18.4 – 21.4 | Mars | 1.5 | Parts of southern Australia, Tasmania, Antarctica, South Georgia Island, southernmost tip of South America, Falkland Islands. |

## OCCULTATIONS, 2021

ELEMENTS OF OCCULTATIONS OF PLANETS

| Sl. No. | $T_0$ (U.T. of Conj. in R.A.) | | | $H_0$ | | Y | x′ | y′ | Body Occulted | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Right Ascension | | | Declination | | |
| | d | h | m | h | m | | | | h | m | s | ° | ′ | ″ |
| 1. | Apr – 17 | 12 | 07.8 | 20 | 08.3 | -0.1466 | 0.5185 | 0.0624 | 5 | 44 | 01.3 | 24 | 51 | 23.9 |
| 2. | May – 12 | 22 | 02.8 | 33 | 16.7 | -0.7904 | 0.4728 | 0.1367 | 4 | 10 | 55.4 | 21 | 12 | 36.7 |
| 3. | Nov – 03 | 18 | 39.0 | 7 | 51.6 | 1.2152 | 0.4949 | -0.2375 | 13 | 41 | 31.7 | -8 | 27 | 34.4 |
| 4. | Nov – 08 | 5 | 20.9 | -9 | 39.2 | 1.1011 | 0.5721 | -0.0361 | 18 | 11 | 42.6 | -27 | 13 | 49.0 |
| 5. | Dec – 03 | 0 | 27.6 | -10 | 04.7 | 0.6853 | 0.5551 | -0.2036 | 15 | 21 | 40.0 | -18 | 18 | 01.1 |
| 6. | Dec – 31 | 20 | 12.8 | 10 | 09.7 | -0.9331 | 0.5757 | -0.1274 | 16 | 46 | 09.4 | -22 | 29 | 03.0 |

## OCCULTATIONS, 2021

ELEMENTS (contd.)

| Sl. No. | *l* | *a* |
|---|---|---|
| 1. | 0.2729 | 1.00 |
| 2. | 0.2729 | 1.00 |
| 3. | 0.2730 | 1.00 |
| 4. | 0.2736 | 1.00 |
| 5. | 0.2728 | 1.00 |
| 6. | 0.2728 | 1.00 |

# PART - V

## ASTRONOMICAL PHENOMENA
## AND
## MISCELLANEOUS TABLES

## PHENOMENA, 2021

ELONGATIONS AND MAGNITUDES OF PLANETS AT $0^h$ U.T.

| Date | Mercury Elong. | Mercury Mag. | Venus Elong. | Venus Mag. | Date | Mercury Elong. | Mercury Mag. | Venus Elong. | Venus Mag. |
|---|---|---|---|---|---|---|---|---|---|
| | ° | | ° | | | ° | | ° | |
| Jan. -4 | E. 4 | -1.1 | W. 22 | -3.9 | June 30 | W. 21 | +1.0 | E. 25 | -3.8 |
| 1 | 7 | -1.0 | 20 | -3.9 | July 5 | 22 | +0.3 | 26 | -3.9 |
| 6 | 10 | -0.9 | 19 | -3.9 | 10 | 21 | -0.2 | 28 | -3.9 |
| 11 | 13 | -0.9 | 18 | -3.9 | 15 | 18 | -0.7 | 29 | -3.9 |
| 16 | 16 | -0.9 | 17 | -3.9 | 20 | 14 | -1.1 | 30 | -3.9 |
| 21 | E. 18 | -0.8 | W. 16 | -3.9 | 25 | W. 9 | -1.5 | E. 31 | -3.9 |
| 26 | 18 | -0.5 | 15 | -3.9 | 30 | W. 3 | -2.0 | 33 | -3.9 |
| 31 | 15 | +0.7 | 13 | -3.9 | Aug 4 | E. 3 | -1.9 | 34 | -3.9 |
| Feb. 5 | E. 8 | +3.3 | 12 | -3.9 | 9 | 8 | -1.2 | 35 | -3.9 |
| 10 | W. 5 | +4.8 | 11 | -3.9 | 14 | 12 | -0.8 | 36 | -4.0 |
| 15 | W. 14 | +2.2 | W. 10 | -3.9 | 19 | E. 16 | -0.5 | E. 37 | -4.0 |
| 20 | 21 | +0.9 | 9 | -3.9 | 24 | 20 | -0.3 | 38 | -4.0 |
| 25 | 25 | +0.3 | 7 | -3.9 | 29 | 22 | -0.1 | 39 | -4.0 |
| Mar. 2 | 27 | +0.1 | 6 | -3.9 | Sept 3 | 25 | 0 | 40 | -4.0 |
| 7 | 27 | +0.1 | 5 | -3.9 | 8 | 26 | 0 | 41 | -4.1 |
| 12 | W. 27 | 0 | W. 4 | -3.9 | 13 | E. 27 | +0.1 | E. 42 | -4.1 |
| 17 | 25 | 0 | 3 | -3.9 | 18 | 26 | +0.1 | 43 | -4.1 |
| 22 | 23 | -0.1 | W. 2 | -4.0 | 23 | 25 | +0.3 | 44 | -4.2 |
| 27 | 20 | -0.3 | E. 1 | ---- | 28 | 21 | +0.9 | 44 | -4.2 |
| Apr. 1 | 17 | -0.5 | 2 | -4.0 | Oct. 3 | 14 | +2.2 | 45 | -4.3 |
| 6 | W. 13 | -0.8 | E. 3 | -3.9 | 8 | E. 4 | +5.0 | E. 46 | -4.3 |
| 11 | 9 | -1.2 | 4 | -3.9 | 13 | W. 7 | +3.7 | 46 | -4.4 |
| 16 | W. 4 | -1.8 | 5 | -3.9 | 18 | 15 | +0.8 | 47 | -4.4 |
| 21 | E. 2 | -2.2 | 7 | -3.9 | 23 | 18 | -0.4 | 47 | -4.5 |
| 26 | 8 | -1.6 | 8 | -3.9 | 28 | 18 | -0.8 | 47 | -4.5 |
| May 1 | E. 13 | -1.1 | E. 9 | -3.9 | Nov 2 | W. 16 | -0.8 | E. 47 | -4.6 |
| 6 | 18 | -0.7 | 11 | -3.9 | 7 | 13 | -0.9 | 47 | -4.6 |
| 11 | 21 | -0.3 | 12 | -3.9 | 12 | 10 | -0.9 | 46 | -4.7 |
| 16 | 22 | +0.2 | 13 | -3.9 | 17 | 7 | -1.0 | 46 | -4.7 |
| 21 | 22 | +0.8 | 14 | -3.9 | 22 | 4 | -1.1 | 45 | -4.8 |
| 26 | E. 19 | +1.6 | E. 16 | -3.9 | 27 | W. 1 | -1.3 | E. 43 | -4.8 |
| 31 | 15 | +2.8 | 17 | -3.8 | Dec. 2 | E. 2 | -1.3 | 41 | -4.9 |
| June 5 | 9 | +4.3 | 18 | -3.8 | 7 | 5 | -1.0 | 39 | -4.9 |
| 10 | E. 3 | ---- | 20 | -3.8 | 12 | 7 | -0.9 | 35 | -4.9 |
| 15 | W. 7 | +4.9 | 21 | -3.8 | 17 | 10 | -0.8 | 31 | -4.8 |
| 20 | W. 13 | +3.2 | E. 22 | -3.8 | 22 | E. 13 | -0.7 | E. 26 | -4.7 |
| 25 | 18 | +1.9 | 24 | -3.8 | 27 | 15 | -0.7 | 20 | -4.5 |
| 30 | W. 21 | +1.0 | E. 25 | -3.8 | 32 | E. 18 | -0.7 | E. 13 | -4.3 |

| Conjunction- | Mercury | Venus | Mercury | Venus |
|---|---|---|---|---|
| | d h / d h | d h | d h | d h |
| Superior: | Apr. 19 01 / Aug. 1 14 | Mar. 26 07 | Nov. 29 04 | … |
| Inferior: | Feb. 8 13 / June 11 01 | … | Oct. 9 16 | … |

N.B.- E. means that the planet is in the east of the Sun and W. means that it is in the west of the Sun by the amount of the arc stated.

## PHENOMENA, 2021

ELONGATIONS AND MAGNITUDES OF PLANETS AT $0^h$ UT

| Date | Mars Elong. | Mars Mag. | Jupiter Elong. | Jupiter Mag. | Saturn Elong. | Saturn Mag. | Uranus Elong. | Neptune Elong. | Pluto Elong. |
|---|---|---|---|---|---|---|---|---|---|
| | ° | | ° | | ° | | ° | ° | ° |
| Jan. -4 | E. 110 | -0.4 | E. 26 | -2.0 | E. 25 | +0.6 | E. 121 | E. 73 | E. 18 |
| 6 | 104 | -0.1 | 18 | -1.9 | 16 | +0.6 | 111 | 63 | E. 9 |
| 16 | 98 | +0.1 | 10 | -1.9 | E. 7 | +0.6 | 101 | 53 | W. 2 |
| 26 | 93 | +0.3 | E. 2 | -1.9 | W. 2 | +0.6 | 91 | 43 | 11 |
| Feb. 5 | 88 | +0.5 | W. 5 | -1.9 | 11 | +0.6 | 81 | 33 | 21 |
| 15 | E. 84 | +0.7 | W. 13 | -2.0 | W. 20 | +0.7 | E. 71 | E. 23 | W. 31 |
| 25 | 79 | +0.9 | 21 | -2.0 | 29 | +0.7 | 61 | 14 | 41 |
| Mar. 7 | 75 | +1.0 | 29 | -2.0 | 38 | +0.7 | 51 | E. 4 | 50 |
| 17 | 71 | +1.1 | 36 | -2.0 | 47 | +0.7 | 42 | W. 6 | 60 |
| 27 | 67 | +1.2 | 44 | -2.0 | 56 | +0.8 | 32 | 15 | 70 |
| Apr. 6 | E. 63 | +1.3 | W. 52 | -2.1 | W. 65 | +0.8 | E. 23 | W. 25 | W. 80 |
| 16 | 59 | +1.4 | 60 | -2.1 | 74 | +0.7 | 14 | 34 | 89 |
| 26 | 56 | +1.5 | 68 | -2.2 | 83 | +0.7 | E. 4 | 44 | 99 |
| May 6 | 52 | +1.6 | 77 | -2.2 | 92 | +0.7 | W. 5 | 53 | 109 |
| 16 | 48 | +1.7 | 85 | -2.3 | 102 | +0.7 | 14 | 63 | 119 |
| 26 | E. 45 | +1.7 | W. 94 | -2.4 | W. 111 | +0.6 | W. 23 | W. 72 | W. 128 |
| June 5 | 41 | +1.7 | 103 | -2.5 | 121 | +0.5 | 32 | 81 | 138 |
| 15 | 38 | +1.8 | 112 | -2.5 | 131 | +0.5 | 41 | 91 | 148 |
| 25 | 35 | +1.8 | 122 | -2.6 | 141 | +0.4 | 50 | 100 | 158 |
| July 5 | 31 | +1.8 | 131 | -2.7 | 151 | +0.4 | 59 | 110 | W. 167 |
| 15 | E. 28 | +1.8 | W. 141 | -2.7 | W. 161 | +0.3 | W. 68 | W. 120 | W. 177 |
| 25 | 25 | +1.8 | 152 | -2.8 | W. 171 | +0.2 | 78 | 129 | E. 173 |
| Aug 4 | 21 | +1.8 | 163 | -2.8 | E. 178 | +0.2 | 87 | 139 | 163 |
| 14 | 18 | +1.8 | W. 173 | -2.9 | 168 | +0.2 | 97 | 149 | 153 |
| 24 | 15 | +1.8 | E. 175 | -2.9 | 158 | +0.3 | 106 | 159 | 144 |
| Sept 3 | E. 12 | +1.8 | E. 165 | -2.8 | E. 147 | +0.3 | W. 116 | W. 169 | E. 134 |
| 13 | 8 | +1.7 | 154 | -2.8 | 137 | +0.4 | 126 | W. 178 | 124 |
| 23 | 5 | +1.7 | 143 | -2.8 | 127 | +0.4 | 136 | E. 171 | 114 |
| Oct. 3 | E. 2 | +1.7 | 133 | -2.7 | 117 | +0.5 | 146 | 161 | 104 |
| 13 | W. 2 | +1.6 | 122 | -2.6 | 107 | +0.5 | 156 | 151 | 94 |
| 23 | W. 5 | +1.7 | E. 113 | -2.6 | E. 97 | +0.6 | W. 166 | E. 141 | E. 85 |
| Nov 2 | 8 | +1.7 | 103 | -2.5 | 88 | +0.6 | W. 177 | 131 | 75 |
| 12 | 11 | +1.6 | 94 | -2.4 | 78 | +0.7 | E. 173 | 121 | 65 |
| 22 | 15 | +1.6 | 84 | -2.4 | 68 | +0.7 | 162 | 111 | 55 |
| Dec. 2 | 18 | +1.6 | 76 | -2.3 | 59 | +0.7 | 152 | 100 | 45 |
| 12 | W. 21 | +1.6 | E. 67 | -2.2 | E. 50 | +0.7 | E. 141 | E. 90 | E. 35 |
| 22 | 24 | +1.6 | 58 | -2.2 | 41 | +0.7 | 131 | 80 | 25 |
| 32 | W. 27 | +1.5 | E. 50 | -2.1 | E. 31 | +0.7 | E. 120 | E. 70 | E. 15 |

| | Mars | Jupiter | Saturn | Uranus | Neptune | Pluto |
|---|---|---|---|---|---|---|
| | d h | d h | d h | d h | d h | d h |
| Conjunction: | Oct. 8 04 | Jan. 29 01 | Jan. 24 03 | Apr. 30 20 | Mar. 11 00 | Jan. 14 14 |
| Opposition: | … | Aug. 20 00 | Aug. 2 06 | Nov. 5 00 | Sept. 14 09 | July 17 22 |

Magnitudes at opposition: Uranus +5.7; Neptune +7.9; Pluto +14.4

N.B. - E. means that the planet is in the east of the Sun and W. means that it is in the west of the Sun by the amount of the arc stated.

# PHENOMENA, 2021

CONJUNCTIONS, OPPOSITIONS ETC. OF PLANETS WITH THE SUN (IN LONGTITUDE)

UNIVERSAL TIME

## MERCURY

| | | d | h | m | | | d | h | m | |
|---|---|---|---|---|---|---|---|---|---|---|
| Heliacal rising W. | Jan. | 7 | 06 | 06 | | | … | … | … | |
| Greatest elongation E. | Jan. | 24 | 01 | 57 | (18˚.6) | | … | … | … | |
| Retrograde | Jan. | 30 | 15 | 49 | | May | 29 | 22 | 40 | |
| Heliacal setting W. | Feb. | 3 | 17 | 48 | | June | 3 | 04 | 05 | |
| Inferior conjunction | Feb. | 8 | 13 | 46 | | June | 11 | 01 | 13 | |
| Heliacal rising E. | Feb. | 13 | 08 | 34 | | June | 21 | 13 | 19 | |
| Direct | Feb. | 21 | 01 | 05 | | June | 22 | 21 | 54 | |
| Greatest elongation W. | Mar. | 6 | 11 | 22 | (27˚.3) | July | 4 | 19 | 45 | (21˚.6) |
| Heliacal setting E. | Mar. | 31 | 20 | 22 | | July | 23 | 14 | 21 | |
| Superior conjuction | Apr. | 19 | 01 | 49 | | Aug. | 1 | 14 | 10 | |
| | | | | | | | | | | |
| Heliacal rising W. | Apr. | 27 | 19 | 24 | | Aug. | 14 | 14 | 49 | |
| Greatest elongation E. | May | 17 | 05 | 54 | (22˚.0) | Sept. | 14 | 04 | 24 | (26˚.8) |
| Retrograde | | … | … | … | | Sept. | 27 | 04 | 59 | |
| Heliacal setting W. | | … | … | … | | Sept. | 29 | 21 | 13 | |
| Inferior conjunction | | … | … | … | | Oct. | 9 | 16 | 19 | |
| Heliacal rising E. | | … | … | … | | Oct. | 14 | 16 | 53 | |
| Direct | | … | … | … | | Oct. | 18 | 15 | 20 | |
| Greatest elongation W. | | … | … | … | | Oct. | 25 | 05 | 30 | (18˚.4) |
| Heliacal setting E. | | … | … | … | | Nov. | 12 | 05 | 36 | |
| Superior conjuction | | … | … | … | | Nov. | 29 | 04 | 40 | |
| | | | | | | | | | | |
| Heliacal rising W. | Dec. | 20 | 03 | 02 | | | … | … | … | |

## VENUS

| | | d | h | m | | d | h | m | |
|---|---|---|---|---|---|---|---|---|---|
| Heliacal rising W. | | … | … | … | Apr. | 19 | 00 | 11 | |
| Greatest elongation E. | | … | … | … | Oct. | 29 | 20 | 52 | (47˚.0) |
| Retrograde | | … | … | … | Dec. | 19 | 10 | 34 | |
| Heliacal setting W. | | … | … | … | | … | … | … | |
| Inferior conjunction | | … | … | … | | … | … | … | |
| Heliacal rising E. | | … | … | … | | … | … | … | |
| Direct | | … | … | … | | … | … | … | |
| Greatest elongation W. | | … | … | … | | … | … | … | |
| Heliacal setting E. | Feb. | 17 | 04 | 40 | | … | … | … | |
| Superior conjuction | Mar. | 26 | 06 | 58 | | … | … | … | |

## EARTH

| | | d | h | m | | | d | h | m | | d | h | m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Perihelion | Jan. | 2 | 13 | 57 | Equinoxes | Mar. | 20 | 09 | 37 | Sept. | 22 | 19 | 21 |
| Aphelion | July | 5 | 22 | 16 | Solstices | June | 21 | 03 | 32 | Dec. | 21 | 15 | 59 |

## SUPERIOR PLANETS

| | MARS | | | | JUPITER | | | | SATURN | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | d | h | m | | d | h | m | | d | h | m |
| Heliacal setting W. | Aug. | 10 | 21 | 52 | Jan. | 17 | 21 | 15 | Jan. | 10 | 10 | 07 |
| Conjunction | Oct. | 8 | 04 | 01 | Jan. | 29 | 01 | 40 | Jan. | 24 | 03 | 02 |
| Heliacal rising E. | Nov. | 20 | 00 | 48 | Feb. | 13 | 04 | 36 | Feb. | 10 | 20 | 30 |
| Retrograde | | … | … | … | June | 20 | 15 | 06 | May | 23 | 09 | 20 |
| Opposition | | … | … | … | Aug. | 20 | 00 | 29 | Aug. | 2 | 06 | 14 |
| Direct | | … | … | … | Oct. | 18 | 05 | 30 | Oct. | 11 | 02 | 19 |

## PHENOMENA, 2021

CONJUNCTIONS, OPPOSITIONS ETC. OF PLANETS WITH THE SUN (IN LONGITUDE)

UNIVERSAL TIME

SUPERIOR PLANETS

| | URANUS | | | | NEPTUNE | | | | PLUTO | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | d | h | m | | d | h | m | | d | h | m |
| Conjuction | Apr. | 30 | 19 | 53 | Mar. | 11 | 00 | 01 | Jan. | 14 | 14 | 19 |
| Retrograde | Aug. | 20 | 01 | 39 | June | 25 | 19 | 18 | Apr. | 27 | 19 | 55 |
| Opposition | Nov. | 4 | 23 | 57 | Sept. | 14 | 09 | 21 | July | 17 | 22 | 46 |
| Direct | Jan. | 14 | 08 | 38 | Dec. | 1 | 13 | 26 | Oct. | 6 | 18 | 25 |

N.B.- The heliacal risings and settings have been calcuted for 23° 11' north latitude. Here E. means east of the Sun or the western horizon and W. means west of the Sun or the eastern horizon.

## PHENOMENA, 2021

CONJUNCTION OF PLANETS WITH THE MOON AND OTHER PLANETS (IN LONGITUDE)

UNIVERSAL TIME

| | d | h | m | | | d | h | m | |
|---|---|---|---|---|---|---|---|---|---|
| Jan. | 10 | 03 | 17 | *Mercury conj. Saturn* | Apr. | 12 | 12 | 07 | Moon conj. Venus |
| | 11 | 17 | 19 | *Mercury conj. Jupiter* | | 17 | 12 | 09 | Moon conj. Mars |
| | 11 | 20 | 14 | Moon conj. Venus | | 25 | 22 | 19 | *Mercury conj. Venus* |
| | 13 | 22 | 11 | Moon conj. Saturn | May | 3 | 19 | 08 | Moon conj. Saturn |
| | 14 | 02 | 54 | Moon conj. Jupiter | | 5 | 00 | 05 | Moon conj. Jupiter |
| | 14 | 09 | 28 | Moon conj. Mercury | | 12 | 22 | 21 | Moon conj. Venus |
| | 21 | 09 | 09 | Moon conj. Mars | | 13 | 18 | 33 | Moon conj. Mercury |
| Feb. | 6 | 07 | 07 | *Venus conj. Saturn* | | 16 | 05 | 06 | Moon conj. Mars |
| | 10 | 12 | 42 | Moon conj. Saturn | | 29 | 05 | 13 | *Mercury conj. Venus* |
| | 10 | 22 | 11 | Moon conj. Venus | | 31 | 03 | 25 | Moon conj. Saturn |
| | 10 | 23 | 29 | Moon conj. Jupiter | June | 1 | 12 | 04 | Moon conj. Jupiter |
| | 11 | 07 | 22 | Moon conj. Mercury | | 10 | 12 | 37 | Moon conj. Mercury |
| | 11 | 15 | 00 | *Venus conj. Jupiter* | | 12 | 06 | 59 | Moon conj. Venus |
| | 13 | 07 | 47 | *Mercury conj. Venus* | | 13 | 21 | 08 | Moon conj. Mars |
| | 14 | 21 | 40 | *Mercury conj. Jupiter* | | 27 | 11 | 23 | Moon conj. Saturn |
| | 19 | 00 | 48 | Moon conj. Mars | | 28 | 21 | 33 | Moon conj. Jupiter |
| Mar. | 5 | 03 | 27 | *Mercury conj. Jupiter* | July | 8 | 04 | 20 | Moon conj. Mercury |
| | 10 | 00 | 45 | Moon conj. Saturn | | 12 | 11 | 14 | Moon conj. Venus |
| | 10 | 17 | 58 | Moon conj. Jupiter | | 12 | 12 | 29 | Moon conj. Mars |
| | 11 | 03 | 32 | Moon conj. Mercury | | 13 | 13 | 33 | *Venus conj. Mars* |
| | 13 | 03 | 29 | Moon conj. Venus | | 24 | 18 | 24 | Moon conj. Saturn |
| | 19 | 18 | 26 | Moon conj. Mars | | 26 | 03 | 56 | Moon conj. Jupiter |
| Apr. | 6 | 10 | 32 | Moon conj. Saturn | Aug. | 9 | 05 | 45 | Moon conj. Mercury |
| | 7 | 10 | 05 | Moon conj. Jupiter | | 10 | 03 | 42 | Moon conj. Mars |
| | 11 | 08 | 46 | Moon conj. Mercury | | 11 | 10 | 15 | Moon conj. Venus |

**PHENOMENA, 2021 --- contd.**

CONJUNCTION OF PLANETS WITH THE MOON AND OTHER PLANETS (IN LONGITUDE)

UNIVERSAL TIME

| d h m | | d h m | |
|---|---|---|---|
| Aug. 19 03 28 | *Mercury conj. Mars* | Oct. 15 12 29 | Moon conj. Jupiter |
| 20 23 55 | Moon conj. Saturn | Nov. 3 19 27 | Moon conj. Mercury |
| 22 07 18 | Moon conj. Jupiter | 4 05 55 | Moon conj. Mars |
| Sept. 7 19 23 | Moon conj. Mars | 8 05 18 | Moon conj. Venus |
| 9 01 01 | Moon conj. Mercury | 10 12 56 | *Mercury conj. Mars* |
| 10 04 48 | Moon conj. Venus | 10 16 15 | Moon conj. Saturn |
| 17 04 14 | Moon conj. Saturn | 11 19 52 | Moon conj. Jupiter |
| 18 09 14 | Moon conj. Jupiter | Dec. 3 00 45 | Moon conj. Mars |
| Oct. 6 12 03 | Moon conj. Mars | 4 12 42 | Moon conj. Mercury |
| 6 21 40 | Moon conj. Mercury | 7 01 21 | Moon conj. Venus |
| 9 19 36 | Moon conj. Venus | 8 03 43 | Moon conj. Saturn |
| 9 22 48 | *Mercury conj. Mars* | 9 08 53 | Moon conj. Jupiter |
| 14 08 54 | Moon conj. Saturn | | |

CONJUNCTIONS OF PLANETS WITH BRIGHT STARS (IN R.A.)

| d h m | | d h m | |
|---|---|---|---|
| Mar. 22 23 39 | Mars 7°.02 N. of Aldebaran | Aug. 11 18 12 | Mercury 1°.17 N. of Regulus |
| May 11 02 35 | Mercury 7°.99 N. of Aldebaran | Sept. 5 05 38 | Venus 1°.74 N. of Spica |
| May 17 23 04 | Venus 5°.87 N. of Aldebaran | Sept. 23 11 56 | Mercury 1°.67 S. of Spica |
| June 2 13 59 | Mars 5°.42 S. of Pollux | Sept. 30 15 12 | Mercury 1°.74 S. of Spica |
| June 22 14 41 | Venus 5°.26 S. of Pollux | Oct. 16 13 37 | Venus 1°.47 N. of Antares |
| July 21 18 46 | Venus 1°.17 N. of Regulus | Oct. 20 06 12 | Mars 2°.81 N. of Spica |
| July 25 10 34 | Mercury 5°.74 S. of Pollux | Nov. 1 01 40 | Mercury 4°.44 N. of Spica |
| July 29 15 57 | Mars 0°.68 N. of Regulus | Nov. 30 16 07 | Mercury 3°.75 N. of Antares |
| | | Dec. 26 18 00 | Mars 4°.55 N. of Antares |

## ASTRONOMICAL DIARY, 2021

UNIVERSAL TIME

| | d | h | m | | | d | h | m | |
|---|---|---|---|---|---|---|---|---|---|
| Jan. | 2 | 13 | 57 | Earth at perihelion | Feb. | 13 | 16 | 57 | Neptune 4°.3 N of Moon |
| | 3 | 17 | 53 | Moon greatest lat. N 5° 10' | | 13 | 18 | 43 | Mercury 4°.2 N of Jupiter |
| | 5 | 08 | 32 | Mercury greatest helio. lat S. | | 17 | 15 | 48 | Uranus 3° N of Moon |
| | 6 | 09 | 37 | LAST QUARTER | | 18 | 10 | 21 | Moon at apogee |
| | 9 | 15 | 37 | Moon at perigee | | 18 | 22 | 46 | Mars 3°7 N of Moon |
| | 9 | 21 | 16 | Mercury 1°.7 S. of Saturn | | 19 | 18 | 47 | FIRST QUARTER |
| | 10 | 20 | 16 | Moon in descending node | | 20 | 08 | 44 | Venus at aphelion |
| | 11 | 11 | 07 | Mercury 1°.5 S. of Jupiter | | 20 | 12 | 32 | Mercury stationary in RA |
| | 11 | 20 | 09 | Venus 1°.5 N. of Moon | | 21 | 01 | 45 | Moon in ascending node |
| | 13 | 20 | 52 | Saturn 3°.2 N of Moon | | 27 | 08 | 17 | FULL MOON |
| | | | | | | | | | |
| | 14 | 01 | 27 | Jupiter 3°.3 N of Moon | | 27 | 09 | 56 | Moon greatest lat. N 4° 58' |
| | 14 | 08 | 13 | Mercury 2°.3 N of Moon | Mar. | 2 | 05 | 16 | Moon at perigee |
| | 14 | 14 | 19 | Pluto in conjunction with Sun | | 3 | 17 | 04 | Mercury in descending node |
| | 14 | 13 | 39 | Uranus stationary in RA | | 5 | 06 | 46 | Mercury 0°.3 N of Jupiter |
| | 16 | 11 | 51 | Venus in descending node | | 6 | 00 | 56 | Moon in descending node |
| | 16 | 17 | 13 | Moon greatest lat. S 5° 07' | | 6 | 01 | 30 | LAST QUARTER |
| | 17 | 06 | 14 | Neptune 4°.5 N of Moon | | 6 | 11 | 22 | Mercury greatest elong. W. (27°.3) |
| | 20 | 21 | 02 | FIRST QUARTER | | 9 | 22 | 57 | Saturn 3°.7 N of Moon |
| | 21 | 05 | 37 | Mars 5°.1 N of Moon | | 10 | 15 | 36 | Jupiter 4°.0 N of Moon |
| | 21 | 06 | 24 | Uranus 3°.3 N of Moon | | 11 | 00 | 01 | Neptune in conjunction with Sun |
| | | | | | | | | | |
| | 21 | 13 | 10 | Moon at apogee | | 11 | 01 | 01 | Mercury 3°.7 N of Moon |
| | 21 | 23 | 35 | Mars 1°.7 N. of Uranus | | 12 | 09 | 12 | Moon greatest lat. S 4° 57' |
| | 24 | 01 | 57 | Mercury greatest elong. E. (18°.6) | | 13 | 00 | 15 | Venus 3°.9 N. of Moon |
| | 24 | 03 | 02 | Saturn in conjunction with Sun | | 13 | 02 | 38 | Neptune 4°.3 N of Moon |
| | 24 | 10 | 02 | Mercury in ascending node | | 13 | 10 | 21 | NEW MOON |
| | 24 | 21 | 48 | Moon in ascending node | | 14 | 01 | 00 | Venus 0°.4 S of Neptune |
| | 26 | 12 | 48 | Uranus in square with Sun | | 14 | 01 | 46 | Mercury at aphelion |
| | 28 | 19 | 16 | FULL MOON | | 14 | 08 | 07 | Venus greatest helio. lat S. |
| | 29 | 01 | 40 | Jupiter in conjunction with Sun | | 17 | 01 | 50 | Uranus 2°.7 N of Moon |
| | 29 | 02 | 09 | Mercury at perihelion | | 18 | 05 | 02 | Moon at apogee |
| | | | | | | | | | |
| | 30 | 02 | 13 | Mercury stationary in RA | | 19 | 17 | 47 | Mars 1°.9 N of Moon |
| | 31 | 07 | 52 | Moon greatest lat. N 5° 02' | | 20 | 03 | 30 | *Moon in ascending node* |
| Feb. | 1 | 10 | 35 | Mars in square with Sun | | 20 | 09 | 37 | Vernal Equinox |
| | 3 | 19 | 05 | *Moon at perigee* | | 21 | 14 | 40 | FIRST QUARTER |
| | 4 | 17 | 37 | LAST QUARTER | | 22 | 23 | 39 | Mars 7°.0 N of Aldebaran |
| | 6 | 05 | 06 | Venus 0°.4 S of Saturn | | 26 | 06 | 58 | Venus in superior conjunction |
| | 7 | 00 | 29 | *Moon in descending node* | | | | | 1° 21' S of Sun |
| | 8 | 07 | 25 | Mercury greatest helio. lat N. | | 26 | 12 | 41 | Moon greatest lat. N 5° 02' |
| | 8 | 13 | 46 | Mercury in inferior conjunction | | 28 | 18 | 48 | FULL MOON |
| | | | | 3° 37' N of Sun | | 29 | 19 | 15 | *Mercury 1°.4 S of Neptune* |
| | | | | | | | | | |
| | 10 | 11 | 10 | Saturn 3°.4 N of Moon | | 30 | 06 | 15 | Moon at perigee |
| | 10 | 20 | 25 | Venus 3°.2 N. of Moon | Apr. | 2 | 02 | 42 | Moon in descending node |
| | 10 | 21 | 35 | Jupiter 3°.7 N of Moon | | 3 | 07 | 45 | Mercury greatest helio. lat S. |
| | 11 | 03 | 17 | Mercury 8°.3 N of Moon | | 4 | 10 | 02 | LAST QUARTER |
| | 11 | 12 | 02 | Venus 0°.4 S of Jupiter | | 6 | 08 | 29 | Saturn 4°N of Moon |
| | 11 | 19 | 06 | NEW MOON | | 7 | 07 | 17 | Jupiter 4°.4 N of Moon |
| | 12 | 16 | 49 | Mercury 4°.8 N of Venus | | 8 | 09 | 58 | Moon greatest lat. S 5° 04' |
| | 13 | 07 | 58 | Moon greatest lat. S 4° 59' | | 9 | 10 | 44 | Neptune 4°.3 N of Moon |

## ASTRONOMICAL DIARY, 2021

UNIVERSAL TIME

| | d | h | m | | | d | h | m | |
|---|---|---|---|---|---|---|---|---|---|
| Apr. | 11 | 06 | 01 | Mercury 3° N of Moon | May | 29 | 05 | 33 | Mercury 0°.4 S of Venus |
| | 12 | 09 | 48 | Venus 2°.9 N. of Moon | | 30 | 01 | 56 | Mercury stationary in RA |
| | 12 | 02 | 31 | NEW MOON | | 30 | 16 | 05 | Mercury in descending node |
| | 13 | 11 | 41 | Uranus 2°.5 N of Moon | | 31 | 01 | 18 | Saturn 4°.2 N of Moon |
| | 14 | 17 | 46 | Moon at apogee | June | 1 | 09 | 00 | Jupiter 4°.6 N of Moon |
| | 16 | 05 | 52 | Moon in ascending node | | 1 | 14 | 40 | Moon greatest lat. S 5° 15' |
| | 16 | 13 | 23 | Pluto in square with Sun | | 2 | 07 | 24 | LAST QUARTER |
| | 17 | 12 | 08 | Mars 0°.1 N of Moon | | 2 | 13 | 59 | Mars 5°.4 S of Pollux |
| | | | | *Occultation* | | 3 | 01 | 06 | Neptune 4°.5 N of Moon |
| | 19 | 01 | 49 | Mercury in superior conjunction | | 4 | 17 | 59 | Mars greatest helio. lat N. |
| | | | | 0° 34' S of Sun | | 7 | 06 | 16 | Uranus 2°.3 N of Moon |
| | 20 | 06 | 59 | FIRST QUARTER | | 8 | 02 | 28 | Moon at apogee |
| | 22 | 09 | 26 | Mercury in ascending node | | 9 | 16 | 42 | Moon in ascending node |
| | 22 | 16 | 18 | Moon greatest lat. N 5° 07' | | 10 | 01 | 01 | Mercury at aphelion |
| | 22 | 23 | 23 | Venus 0°.3 S of Uranus | | 10 | 10 | 53 | NEW MOON; Solar Eclipse |
| | 24 | 09 | 38 | Mercury 0°.8 N of Uranus | | 10 | 13 | 09 | Mercury 4° S of Moon |
| | 26 | 08 | 54 | Mercury 1°.3 N of Venus | | 11 | 01 | 13 | Mercury in inferior conjunction |
| | 27 | 01 | 23 | Mercury at perihelion | | | | | 3° 08' S of Sun |
| | 27 | 03 | 31 | FULL MOON | | 12 | 06 | 42 | Venus 1°.5 S. of Moon |
| | 27 | 15 | 22 | Moon at perigee | | 12 | 17 | 40 | Venus at perihelion |
| | 28 | 18 | 38 | Pluto stationary in RA | | 13 | 19 | 52 | Mars 2°.8 S of Moon |
| | 29 | 09 | 18 | Moon in descending node | | 13 | 23 | 40 | Neptune in square with Sun |
| | 30 | 19 | 53 | Uranus in conjunction with Sun | | 16 | 11 | 05 | Moon greatest lat. N 5° 15' |
| May | 3 | 10 | 01 | Saturn in square with Sun | | 18 | 03 | 54 | FIRST QUARTER |
| | 3 | 16 | 58 | Saturn 4°.2 N of Moon | | 21 | 03 | 32 | *Summer Solstice* |
| | 3 | 19 | 50 | LAST QUARTER | | 21 | 04 | 32 | Jupiter stationary in RA |
| | 4 | 21 | 02 | Jupiter 4°.6 N of Moon | | 22 | 14 | 41 | Venus 5°.3 S of Pollux |
| | 5 | 11 | 39 | Moon greatest lat. S 5° 14' | | 22 | 22 | 32 | Mercury stationary in RA |
| | 6 | 17 | 51 | Neptune 4°.4 N of Moon | | 23 | 06 | 06 | Moon in descending node |
| | 7 | 06 | 41 | Mercury greatest helio. lat N. | | 23 | 09 | 54 | Moon at perigee |
| | 9 | 15 | 27 | Venus in ascending node | | 24 | 18 | 40 | FULL MOON |
| | 10 | 21 | 06 | Uranus 2°.4 N of Moon | | 26 | 09 | 49 | Neptune stationary in RA |
| | 11 | 02 | 35 | Mercury 8° N of Aldebaran | | 27 | 09 | 27 | Saturn 4° N of Moon |
| | 11 | 19 | 00 | NEW MOON | | 28 | 18 | 42 | Jupiter 4°.5 N of Moon |
| | 11 | 21 | 52 | Moon at apogee | | 29 | 06 | 25 | Moon greatest lat. S 5° 10' |
| | 12 | 22 | 03 | Venus 0°.7 N of Moon | | 30 | 06 | 59 | Mercury greatest helio. lat S. |
| | | | | *Occultation* | | 30 | 09 | 09 | Neptune 4°.4 N of Moon |
| | 13 | 10 | 30 | Moon in ascending node | July | 1 | 21 | 11 | LAST QUARTER |
| | 13 | 17 | 59 | Mercury 2°.1 N of Moon | | 4 | 03 | 15 | Venus greatest helio. lat N. |
| | 16 | 04 | 47 | Mars 1°.5 S of Moon | | 4 | 15 | 25 | Uranus 2°.1 N of Moon |
| | 17 | 05 | 54 | Mercury greatest elong. E. (22°) | | 4 | 19 | 45 | Mercury greatest elong. W. (21°.6) |
| | 17 | 23 | 04 | Venus 5°.9 N of Aldebaran | | 5 | 14 | 47 | Moon at apogee |
| | 19 | 19 | 13 | FIRST QUARTER | | 5 | 22 | 16 | Earth at aphelion |
| | 20 | 08 | 02 | Moon greatest lat. N 5° 13' | | 6 | 22 | 40 | Moon in ascending node |
| | 21 | 15 | 03 | Jupiter in square with Sun | | 8 | 04 | 38 | Mercury 3°.8 S of Moon |
| | 23 | 19 | 55 | Saturn stationary in RA | | 10 | 01 | 17 | NEW MOON |
| | 26 | 01 | 49 | *Moon at perigee* | | 12 | 09 | 08 | Venus 3°.3 S of Moon |
| | 26 | 11 | 14 | FULL MOON; Lunar Eclipse | | 12 | 10 | 10 | Mars 3°.8 S of Moon |
| | 26 | 19 | 38 | Moon in descending node | | 13 | 00 | 21 | Mars at aphelion |

**ASTRONOMICAL DIARY, 2021**

UNIVERSAL TIME

| | d | h | m | | | d | h | m | |
|---|---|---|---|---|---|---|---|---|---|
| July | 13 | 07 | 07 | Venus 0˚.5 N of Mars | Sept. | 5 | 16 | 17 | Moon greatest lat. N 4˚ 57' |
| | 13 | 13 | 11 | Moon greatest lat. N 5˚ 08' | | 6 | 00 | 17 | Mercury at aphelion |
| | 17 | 10 | 11 | FIRST QUARTER | | 7 | 00 | 52 | NEW MOON |
| | 17 | 22 | 46 | Pluto in opposition with Sun | | 7 | 16 | 21 | Mars 4˚.2 S of Moon |
| | 19 | 08 | 50 | Mercury in ascending node | | 8 | 20 | 19 | Mercury 6˚.5 S of Moon |
| | 20 | 13 | 22 | Moon in descending node | | 10 | 02 | 09 | Venus 4˚.1 S of Moon |
| | 21 | 10 | 25 | Moon at perigee | | 11 | 10 | 04 | Moon at perigee |
| | 21 | 18 | 47 | Venus 1˚.2 N of Regulus | | 12 | 16 | 36 | Moon in descending node |
| | 24 | 00 | 39 | Mercury at perihelion | | 13 | 20 | 39 | FIRST QUARTER |
| | 24 | 02 | 37 | FULL MOON | | 14 | 04 | 24 | Mercury greatest elong. E. (26˚.8) |
| | 24 | 16 | 39 | Saturn 3˚.8 N of Moon | | 14 | 09 | 21 | Neptune in opposition with Sun |
| | 25 | 10 | 34 | Mercury 5˚.7 S of Pollux | | 17 | 02 | 33 | Saturn 3˚.8 N of Moon |
| | 26 | 01 | 21 | Jupiter 4˚.2 N of Moon | | 18 | 06 | 54 | Jupiter 4˚N of Moon |
| | 26 | 10 | 05 | Moon greatest lat. S 5˚ 04' | | 18 | 14 | 05 | Moon greatest lat. S 5˚ |
| | 27 | 17 | 44 | Neptune 4˚.2 N of Moon | | 20 | 08 | 44 | Neptune 4˚N of Moon |
| | 29 | 15 | 57 | Mars 0˚.7 N of Regulus | | 20 | 23 | 55 | FULL MOON |
| | 31 | 13 | 16 | LAST QUARTER | | 22 | 19 | 21 | Autumnal Equinox |
| Aug. | 1 | 00 | 29 | Uranus 1˚.8 N of Moon | | 23 | 11 | 56 | *Mercury 1˚.7 S of Spica* |
| | 1 | 14 | 10 | Mercury in superior conjunction 1˚ 41' N of Sun | | 24 | 16 | 08 | Uranus 1˚.4 N of Moon |
| | | | | | | 26 | 06 | 13 | Mercury greatest helio. lat S. |
| | 2 | 06 | 14 | Saturn in opposition with Sun | | 26 | 07 | 32 | Moon in ascending node |
| | 2 | 07 | 36 | Moon at apogee | | 26 | 21 | 43 | Moon at apogee |
| | 3 | 02 | 52 | Moon in ascending node | | 27 | 03 | 57 | Mercury stationary in RA |
| | 3 | 05 | 58 | Mercury greatest helio. lat N. | | 29 | 01 | 57 | LAST QUARTER |
| | 6 | 23 | 57 | Uranus in square with Sun | | 30 | 15 | 12 | Mercury 1˚.7 S of Spica |
| | 8 | 13 | 50 | NEW MOON | Oct. | 3 | 00 | 37 | Venus at aphelion |
| | 9 | 03 | 19 | Mercury 3˚.4 S of Moon | | 3 | 07 | 01 | Moon greatest lat. N 5˚ 03' |
| | 9 | 14 | 37 | Moon greatest lat. N 4˚ 59' | | 6 | 09 | 40 | Mars 3˚.6 S of Moon |
| | 10 | 00 | 41 | Mars 4˚.3 S of Moon | | 6 | 11 | 05 | NEW MOON |
| | 11 | 06 | 59 | Venus 4˚.3 S of Moon | | 6 | 12 | 33 | Pluto stationary in RA |
| | 11 | 18 | 12 | Mercury 1˚.2 N of Regulus | | 6 | 17 | 39 | Mercury 6˚.9 S of Moon |
| | 15 | 15 | 20 | FIRST QUARTER | | 8 | 04 | 01 | Mars in conjunction with Sun |
| | 16 | 16 | 05 | Moon in descending node | | 8 | 17 | 27 | Moon at perigee |
| | 17 | 09 | 16 | Moon at perigee | | 9 | 08 | 25 | Mercury 2˚.9 S of Mars |
| | 19 | 04 | 10 | *Mercury 0˚.1 S of Mars* | | 9 | 16 | 19 | Mercury in inferior conjunction 1˚ 54' S of Sun |
| | 20 | 00 | 29 | Jupiter in opposition with Sun | | | | | |
| | 20 | 03 | 30 | Uranus stationary in RA | | 9 | 18 | 36 | Venus 2˚.9 S of Moon |
| | 20 | 22 | 15 | Saturn 3˚.7 N of Moon | | 9 | 19 | 36 | Moon in descending node |
| | 22 | 04 | 56 | Jupiter 4˚ N of Moon | | 11 | 02 | 29 | Saturn stationary in RA |
| | 22 | 12 | 02 | FULL MOON | | 13 | 03 | 25 | FIRST QUARTER |
| | 22 | 12 | 35 | Moon greatest lat. S 5˚ | | 14 | 07 | 08 | Saturn 3˚.9 N of Moon |
| | 24 | 01 | 55 | Neptune 4˚ N of Moon | | 15 | 08 | 07 | Mercury in ascending node |
| | 26 | 15 | 27 | Mercury in descending node | | 15 | 10 | 03 | Jupiter 4˚.1 N of Moon |
| | 28 | 08 | 57 | Uranus 1˚.5 N of Moon | | 15 | 15 | 28 | Moon greatest lat. S 5˚ 07' |
| | 29 | 04 | 34 | Venus in descending node | | 16 | 13 | 37 | Venus 1˚.5 N of Antares |
| | 30 | 02 | 22 | Moon at apogee | | 17 | 12 | 09 | *Pluto in square with Sun* |
| | 30 | 05 | 13 | Moon in ascending node | | 17 | 13 | 58 | Neptune 4˚.1 N of Moon |
| | 30 | 07 | 13 | LAST QUARTER | | 18 | 00 | 56 | Mercury stationary in RA |
| Sept. | 5 | 05 | 38 | Venus 1˚.7 N of Spica | | 18 | 10 | 57 | Jupiter stationary in RA |

## ASTRONOMICAL DIARY, 2021

UNIVERSAL TIME

| | d | h | m | | | d | h | m | |
|---|---|---|---|---|---|---|---|---|---|
| Oct. | 19 | 23 | 57 | Mercury at perihelion | Nov. | 27 | 12 | 28 | LAST QUARTER |
| | 20 | 06 | 12 | Mars 2˚.8 N of Spica | | 29 | 04 | 40 | Mercury in superior conjunction |
| | 20 | 14 | 57 | FULL MOON | | | | | 0˚ 43' S of Sun |
| | 21 | 21 | 40 | Uranus 1˚.3 N of Moon | | 30 | 16 | 07 | Mercury 3˚.8 N of Antares |
| | 23 | 11 | 48 | Moon in ascending node | Dec. | 1 | 22 | 21 | Neptune stationary in RA |
| | 24 | 15 | 30 | Moon at apogee | | 2 | 23 | 34 | Mercury at aphelion |
| | 25 | 00 | 53 | Venus greatest helio. lat S. | | 3 | 00 | 28 | Mars 0˚.7 S of Moon |
| | 25 | 05 | 30 | Mercury greatest elong. W. (18˚.4) | | | | | *Occultation* |
| | 28 | 20 | 05 | LAST QUARTER | | 3 | 14 | 58 | Moon in descending node |
| | 29 | 20 | 52 | Venus greatest elong. E. (47˚.0) | | 4 | 07 | 43 | NEW MOON; *Solar Eclipse* |
| | 30 | 05 | 15 | Mercury greatest helio. lat N. | | 4 | 10 | 05 | Moon at perigee |
| | 30 | 09 | 54 | Saturn in square with Sun | | 4 | 12 | 43 | Mercury 0˚.02 N of Moon |
| | 30 | 10 | 41 | Moon greatest lat. N 5˚ 13' | | 7 | 00 | 48 | Venus 1˚.9 N of Moon |
| Nov. | 1 | 01 | 40 | Mercury 4˚.4 N of Spica | | 8 | 01 | 49 | Saturn 4˚.2 N of Moon |
| | 3 | 18 | 39 | Mercury 1˚.2 S of Moon | | 9 | 06 | 10 | Jupiter 4˚.5 N of Moon |
| | | | | *Occultation* | | 9 | 09 | 02 | Moon greatest lat. S 5˚ 13' |
| | 4 | 04 | 36 | Mars 2˚.3 S of Moon | | 11 | 00 | 44 | Neptune 4˚.2 N of Moon |
| | 4 | 21 | 15 | NEW MOON | | 11 | 01 | 36 | FIRST QUARTER |
| | 4 | 23 | 57 | Uranus in opposition with Sun | | 12 | 06 | 22 | Neptune in square with Sun |
| | 5 | 22 | 19 | Moon at perigee | | 15 | 05 | 53 | Uranus 1˚.5 N of Moon |
| | 6 | 03 | 37 | Moon in descending node | | 17 | 00 | 11 | Moon in ascending node |
| | 8 | 05 | 21 | Venus 1˚.1 S of Moon | | 18 | 02 | 16 | Moon at apogee |
| | | | | *Occultation* | | 18 | 10 | 58 | Venus stationary in RA |
| | 10 | 04 | 05 | Mercury 1˚.1 N of Mars | | 19 | 04 | 35 | FULL MOON |
| | 10 | 14 | 24 | Saturn 4˚.1 N of Moon | | 19 | 17 | 03 | Mars in descending node |
| | 11 | 12 | 46 | FIRST QUARTER | | 20 | 07 | 54 | Venus in ascending node |
| | 11 | 17 | 16 | Jupiter 4˚.4 N of Moon | | 21 | 15 | 59 | *Winter Solstice* |
| | 11 | 17 | 37 | Moon greatest lat. S 5˚ 13' | | 23 | 05 | 27 | Mercury greatest helio. lat S. |
| | 13 | 18 | 37 | Neptune 4˚.2 N of Moon | | 23 | 17 | 20 | Moon greatest lat. N 5˚ 09' |
| | 15 | 19 | 59 | Jupiter in square with Sun | | 26 | 18 | 00 | Mars 4˚.6 N of Antares |
| | 18 | 01 | 51 | Uranus 1˚.5 N of Moon | | 27 | 02 | 24 | LAST QUARTER |
| | 19 | 08 | 57 | FULL MOON; Lunar Eclipse | | 29 | 01 | 00 | Mercury 4˚.2 S of Venus |
| | 19 | 18 | 00 | Moon in ascending node | | 31 | 00 | 36 | Moon in descending node |
| | 21 | 02 | 12 | Moon at apogee | | 31 | 12 | 08 | Moon greatest lat. S 1˚ 15' |
| | 22 | 14 | 50 | Mercury in descending node | | 31 | 20 | 13 | Mars 1˚ N of Moon |
| | 26 | 14 | 32 | Moon greatest lat. N 5˚ 15' | | | | | *Occultation* |

**TABLE-I**
**CONVERSION OF MEAN SOLAR INTO SIDEREAL TIME**
CORRECTION TO BE *ADDED* TO A MEAN TIME INTERVAL

| HOURS | | | MINUTES | | | | SECONDS | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Mean Time | Correction | | Mean Time | Correction | Mean Time | Correction | Mean Time | Correction | Mean Time | Correction |
| h | m | s | m | s | m | s | s | s | s | s |
| 1 | 0 | 09.856 | 1 | 0.164 | 31 | 5.093 | 1 | .003 | 31 | .085 |
| 2 | 0 | 19.713 | 2 | 0.329 | 32 | 5.257 | 2 | .005 | 32 | .088 |
| 3 | 0 | 29.569 | 3 | 0.493 | 33 | 5.421 | 3 | .008 | 33 | .090 |
| 4 | 0 | 39.426 | 4 | 0.657 | 34 | 5.585 | 4 | .011 | 34 | .093 |
| 5 | 0 | 49.282 | 5 | 0.821 | 35 | 5.750 | 5 | .014 | 35 | .096 |
| 6 | 0 | 59.139 | 6 | 0.986 | 36 | 5.914 | 6 | .016 | 36 | .099 |
| 7 | 1 | 08.995 | 7 | 1.150 | 37 | 6.078 | 7 | .019 | 37 | .101 |
| 8 | 1 | 18.852 | 8 | 1.314 | 38 | 6.242 | 8 | .022 | 38 | .104 |
| 9 | 1 | 28.708 | 9 | 1.478 | 39 | 6.407 | 9 | .025 | 39 | .107 |
| 10 | 1 | 38.565 | 10 | 1.643 | 40 | 6.571 | 10 | .027 | 40 | .110 |
| 11 | 1 | 48.421 | 11 | 1.807 | 41 | 6.735 | 11 | .030 | 41 | .112 |
| 12 | 1 | 58.278 | 12 | 1.971 | 42 | 6.900 | 12 | .033 | 42 | .115 |
| 13 | 2 | 08.134 | 13 | 2.136 | 43 | 7.064 | 13 | .036 | 43 | .118 |
| 14 | 2 | 17.991 | 14 | 2.300 | 44 | 7.228 | 14 | .038 | 44 | .120 |
| 15 | 2 | 27.847 | 15 | 2.464 | 45 | 7.392 | 15 | .041 | 45 | .123 |
| 16 | 2 | 37.704 | 16 | 2.628 | 46 | 7.557 | 16 | .044 | 46 | .126 |
| 17 | 2 | 47.560 | 17 | 2.793 | 47 | 7.721 | 17 | .047 | 47 | .129 |
| 18 | 2 | 57.417 | 18 | 2.957 | 48 | 7.885 | 18 | .049 | 48 | .131 |
| 19 | 3 | 07.273 | 19 | 3.121 | 49 | 8.049 | 19 | .052 | 49 | .134 |
| 20 | 3 | 17.129 | 20 | 3.285 | 50 | 8.214 | 20 | .055 | 50 | .137 |
| 21 | 3 | 26.986 | 21 | 3.450 | 51 | 8.378 | 21 | .057 | 51 | .140 |
| 22 | 3 | 36.842 | 22 | 3.614 | 52 | 8.542 | 22 | .060 | 52 | .142 |
| 23 | 3 | 46.699 | 23 | 3.778 | 53 | 8.707 | 23 | .063 | 53 | .145 |
| 24 | 3 | 56.555 | 24 | 3.943 | 54 | 8.871 | 24 | .066 | 54 | .148 |
| | | | 25 | 4.107 | 55 | 9.035 | 25 | .068 | 55 | .151 |
| | | | 26 | 4.271 | 56 | 9.199 | 26 | .071 | 56 | .153 |
| | | | 27 | 4.435 | 57 | 9.364 | 27 | .074 | 57 | .156 |
| | | | 28 | 4.600 | 58 | 9.528 | 28 | .077 | 58 | .159 |
| | | | 29 | 4.764 | 59 | 9.692 | 29 | .079 | 59 | .162 |
| | | | 30 | 4.928 | 60 | 9.856 | 30 | .082 | 60 | .164 |

Local Apparent Sidereal time for any given local mean time
= mean Sid. Time for $0^h$ U.T. (Pages 13 to 16)
— reduction for longitude of place
+ local mean time reckoned from midnight
+ correction for local mean time added (Table-I)
+ Equation of Equinoxes.

Local apparent Sidereal Time for any hour of Universal Time.
= Sid. Time for $0^h$ U.T. (Pages 13 to 16)
+ longitude of place (in time )
+ Universal Time
+ correction for U.T. added (Table-I)
+ Equation of Equinoxes.

*N.B.* The longitude of place is to be taken in time and regarded *positive* for places East of Greenwich. The reduction of Sidereal Time for the longitude of place may be taken from the above table and with the same sign as that of longitude. The correction for the L.M.T. or U.T. added should also be taken from the above table. For details, see the examples given under the EXPLANATION.

## TABLE-II
## CONVERSION OF SIDEREAL INTO MEAN SOLAR TIME
CORRECTION TO BE *SUBTRACTED* FROM A SIDEREAL TIME INTERVAL

| HOURS | | | MINUTES | | | | SECONDS | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sidereal Time | Correction | | Sidereal Time | Correction | Sidereal Time | Correction | Sidereal Time | Correction | Sidereal Time | Correction |
| h | m | s | m | s | m | s | s | s | s | s |
| 1 | 0 | 09.830 | 1 | 0.164 | 31 | 5.079 | 1 | .003 | 31 | .085 |
| 2 | 0 | 19.659 | 2 | 0.328 | 32 | 5.242 | 2 | .005 | 32 | .087 |
| 3 | 0 | 29.489 | 3 | 0.491 | 33 | 5.406 | 3 | .008 | 33 | .090 |
| 4 | 0 | 39.318 | 4 | 0.655 | 34 | 5.570 | 4 | .011 | 34 | .093 |
| 5 | 0 | 49.148 | 5 | 0.819 | 35 | 5.734 | 5 | .014 | 35 | .096 |
| 6 | 0 | 58.977 | 6 | 0.983 | 36 | 5.898 | 6 | .016 | 36 | .098 |
| 7 | 1 | 08.807 | 7 | 1.147 | 37 | 6.062 | 7 | .019 | 37 | .101 |
| 8 | 1 | 18.636 | 8 | 1.311 | 38 | 6.225 | 8 | .022` | 38 | .104 |
| 9 | 1 | 28.466 | 9 | 1.474 | 39 | 6.389 | 9 | .025 | 39 | .106 |
| 10 | 1 | 38.296 | 10 | 1.638 | 40 | 6.553 | 10 | .027 | 40 | .109 |
| 11 | 1 | 48.125 | 11 | 1.802 | 41 | 6.717 | 11 | .030 | 41 | .112 |
| 12 | 1 | 57.955 | 12 | 1.966 | 42 | 6.881 | 12 | .033 | 42 | .115 |
| 13 | 2 | 07.784 | 13 | 2.130 | 43 | 7.045 | 13 | .035 | 43 | .117 |
| 14 | 2 | 17.614 | 14 | 2.294 | 44 | 7.208 | 14 | .038 | 44 | .120 |
| 15 | 2 | 27.443 | 15 | 2.457 | 45 | 7.372 | 15 | .041 | 45 | .123 |
| 16 | 2 | 37.273 | 16 | 2.621 | 46 | 7.536 | 16 | .044 | 46 | .126 |
| 17 | 2 | 47.103 | 17 | 2.785 | 47 | 7.700 | 17 | .046 | 47 | .128 |
| 18 | 2 | 56.932 | 18 | 2.949 | 48 | 7.864 | 18 | .049 | 48 | .131 |
| 19 | 3 | 06.762 | 19 | 3.113 | 49 | 8.027 | 19 | .052 | 49 | .134 |
| 20 | 3 | 16.591 | 20 | 3.277 | 50 | 8.191 | 20 | .055 | 50 | .137 |
| 21 | 3 | 26.421 | 21 | 3.440 | 51 | 8.355 | 21 | .057 | 51 | .139 |
| 22 | 3 | 36.250 | 22 | 3.604 | 52 | 8.519 | 22 | .060 | 52 | .142 |
| 23 | 3 | 46.080 | 23 | 3.768 | 53 | 8.683 | 23 | .063 | 53 | .145 |
| 24 | 3 | 55.909 | 24 | 3.932 | 54 | 8.847 | 24 | .066 | 54 | .147 |
| | | | 25 | 4.096 | 55 | 9.010 | 25 | .068 | 55 | .150 |
| | | | 26 | 4.259 | 56 | 9.174 | 26 | .071 | 56 | .153 |
| | | | 27 | 4.423 | 57 | 9.338 | 27 | .074 | 57 | .156 |
| | | | 28 | 4.587 | 58 | 9.502 | 28 | .076 | 58 | .158 |
| | | | 29 | 4.751 | 59 | 9.666 | 29 | .079 | 59 | .161 |
| | | | 30 | 4.915 | 60 | 9.830 | 30 | .082 | 60 | .164 |

Local Mean Time for any given local apparent Sidereal Time
= Time of preceding transit of First Point of Aries (pages 13 to 16)
16)
+ reduction for longitude of place
+ given local apparent Sidereal Time — Equation of Equinoxes
— correction for Sidereal Time added (Table-II).

*Otherwise*, L.M.T. for any given Sidereal Time may be obtained as follows:-
Given Sidereal Time
— Sidereal Time for $0^h$ U.T. (pages 13 to 16)
+ reduction for longitude of place
= Sidereal interval since $0^h$ L.M.T.
This Sidereal interval corrected by the above table gives the required local mean time.

or, Universal Time for any given Sidereal Time may be obtained as follows:-
Given Sidereal Time —longitude of place —Sidereal Time for $0^h$ U.T. = Sidereal interval since $0^h$ U.T.
This interval converted into Mean Solar Time by the above table gives the Universal Time required.

*N.B.* The reduction for longitude of place is of the same sign as that of the longitude, i.e. *positive* for places East of Greenwich and *negative* for West. See Example under EXPLANATION.

**TABLE-III**
**CONVERSION OF ARC TO TIME**

| DEGREES | | | | | | MINUTES | | SECONDS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ° | h m | ° | h m | ° | h m | ′ | m s | ″ | s | ″ | s | ″ | s |
| 0 | 0 00 | 49 | 3 16 | 98 | 6 32 | 0 | 0 00 | 0 | 0.000 | 0.00 | 0.000 | 0.50 | 0.033 |
| 1 | 0 04 | 50 | 3 20 | 99 | 6 36 | 1 | 0 04 | 1 | 0.067 | .01 | .001 | .51 | .034 |
| 2 | 0 08 | 51 | 3 24 | 100 | 6 40 | 2 | 0 08 | 2 | 0.133 | .02 | .001 | .52 | .035 |
| 3 | 0 12 | 52 | 3 28 | 101 | 6 44 | 3 | 0 12 | 3 | 0.200 | .03 | .002 | .53 | .035 |
| 4 | 0 16 | 53 | 3 32 | 102 | 6 48 | 4 | 0 16 | 4 | 0.267 | .04 | .003 | .54 | .036 |
| 5 | 0 20 | 54 | 3 36 | 103 | 6 52 | 5 | 0 20 | 5 | 0.333 | .05 | .003 | .55 | .037 |
| 6 | 0 24 | 55 | 3 40 | 104 | 6 56 | 6 | 0 24 | 6 | 0.400 | .06 | .004 | .56 | .037 |
| 7 | 0 28 | 56 | 3 44 | 105 | 7 00 | 7 | 0 28 | 7 | 0.467 | .07 | .005 | .57 | .038 |
| 8 | 0 32 | 57 | 3 48 | 106 | 7 04 | 8 | 0 32 | 8 | 0.533 | .08 | .005 | .58 | .039 |
| 9 | 0 36 | 58 | 3 52 | 107 | 7 08 | 9 | 0 36 | 9 | 0.600 | .09 | .006 | .59 | .039 |
| 10 | 0 40 | 59 | 3 56 | 108 | 7 12 | 10 | 0 40 | 10 | 0.667 | 0.10 | 0.007 | 0.60 | 0.040 |
| 11 | 0 44 | 60 | 4 00 | 109 | 7 16 | 11 | 0 44 | 11 | 0.733 | .11 | .007 | .61 | .041 |
| 12 | 0 48 | 61 | 4 04 | 110 | 7 20 | 12 | 0 48 | 12 | 0.800 | .12 | .008 | .62 | .041 |
| 13 | 0 52 | 62 | 4 08 | 111 | 7 24 | 13 | 0 52 | 13 | 0.867 | .13 | .009 | .63 | .042 |
| 14 | 0 56 | 63 | 4 12 | 112 | 7 28 | 14 | 0 56 | 14 | 0.933 | .14 | .009 | .64 | .043 |
| 15 | 1 00 | 64 | 4 16 | 113 | 7 32 | 15 | 1 00 | 15 | 1.000 | .15 | .010 | .65 | .043 |
| 16 | 1 04 | 65 | 4 20 | 114 | 7 36 | 16 | 1 04 | 16 | 1.067 | .16 | .011 | .66 | .044 |
| 17 | 1 08 | 66 | 4 24 | 115 | 7 40 | 17 | 1 08 | 17 | 1.133 | .17 | .011 | .67 | .045 |
| 18 | 1 12 | 67 | 4 28 | 116 | 7 44 | 18 | 1 12 | 18 | 1.200 | .18 | .012 | .68 | .045 |
| 19 | 1 16 | 68 | 4 32 | 117 | 7 48 | 19 | 1 16 | 19 | 1.267 | .19 | .013 | .69 | .046 |
| 20 | 1 20 | 69 | 4 36 | 118 | 7 52 | 20 | 1 20 | 20 | 1.333 | 0.20 | 0.013 | 0.70 | 0.047 |
| 21 | 1 24 | 70 | 4 40 | 119 | 7 56 | 21 | 1 24 | 21 | 1.400 | .21 | .014 | .71 | .047 |
| 22 | 1 28 | 71 | 4 44 | 120 | 8 00 | 22 | 1 28 | 22 | 1.467 | .22 | .015 | .72 | .048 |
| 23 | 1 32 | 72 | 4 48 | 121 | 8 04 | 23 | 1 32 | 23 | 1.533 | .23 | .015 | .73 | .049 |
| 24 | 1 36 | 73 | 4 52 | 122 | 8 08 | 24 | 1 36 | 24 | 1.600 | .24 | .016 | .74 | .049 |
| 25 | 1 40 | 74 | 4 56 | 123 | 8 12 | 25 | 1 40 | 25 | 1.667 | .25 | .017 | .75 | .050 |
| 26 | 1 44 | 75 | 5 00 | 124 | 8 16 | 26 | 1 44 | 26 | 1.733 | .26 | .017 | .76 | .051 |
| 27 | 1 48 | 76 | 5 04 | 125 | 8 20 | 27 | 1 48 | 27 | 1.800 | .27 | .018 | .77 | .051 |
| 28 | 1 52 | 77 | 5 08 | 126 | 8 24 | 28 | 1 52 | 28 | 1.867 | .28 | .019 | .78 | .052 |
| 29 | 1 56 | 78 | 5 12 | 127 | 8 28 | 29 | 1 56 | 29 | 1.933 | .29 | .019 | .79 | .053 |
| 30 | 2 00 | 79 | 5 16 | 128 | 8 32 | 30 | 2 00 | 30 | 2.000 | 0.30 | 0.020 | 0.80 | 0.053 |
| 31 | 2 04 | 80 | 5 20 | 129 | 8 36 | 31 | 2 04 | 31 | 2.067 | .31 | .021 | .81 | .054 |
| 32 | 2 08 | 81 | 5 24 | 130 | 8 40 | 32 | 2 08 | 32 | 2.133 | .32 | .021 | .82 | .055 |
| 33 | 2 12 | 82 | 5 28 | 131 | 8 44 | 33 | 2 12 | 33 | 2.200 | .33 | .022 | .83 | .055 |
| 34 | 2 16 | 83 | 5 32 | 132 | 8 48 | 34 | 2 16 | 34 | 2.267 | .34 | .023 | .84 | .056 |
| 35 | 2 20 | 84 | 5 36 | 133 | 8 52 | 35 | 2 20 | 35 | 2.333 | .35 | .023 | .85 | .057 |
| 36 | 2 24 | 85 | 5 40 | 134 | 8 56 | 36 | 2 24 | 36 | 2.400 | .36 | .024 | .86 | .057 |
| 37 | 2 28 | 86 | 5 44 | 135 | 9 00 | 37 | 2 28 | 37 | 2.467 | .37 | .025 | .87 | .058 |
| 38 | 2 32 | 87 | 5 48 | 136 | 9 04 | 38 | 2 32 | 38 | 2.533 | .38 | .025 | .88 | .059 |
| 39 | 2 36 | 88 | 5 52 | 137 | 9 08 | 39 | 2 36 | 39 | 2.600 | .39 | .026 | .89 | .059 |
| 40 | 2 40 | 89 | 5 56 | 138 | 9 12 | 40 | 2 40 | 40 | 2.667 | 0.40 | 0.027 | 0.90 | 0.06 |
| 41 | 2 44 | 90 | 6 00 | 139 | 9 16 | 41 | 2 44 | 41 | 2.733 | .41 | .027 | .91 | .061 |
| 42 | 2 48 | 91 | 6 04 | 140 | 9 20 | 42 | 2 48 | 42 | 2.800 | .42 | .028 | .92 | .061 |
| 43 | 2 52 | 92 | 6 08 | 141 | 9 24 | 43 | 2 52 | 43 | 2.867 | .43 | .029 | .93 | .062 |
| 44 | 2 56 | 93 | 6 12 | 142 | 9 28 | 44 | 2 56 | 44 | 2.933 | .44 | .029 | .94 | .063 |
| 45 | 3 00 | 94 | 6 16 | 143 | 9 32 | 45 | 3 00 | 45 | 3.000 | .45 | .030 | .95 | .063 |
| 46 | 3 04 | 95 | 6 20 | 144 | 9 36 | 46 | 3 04 | 46 | 3.067 | .46 | .031 | .96 | .064 |
| 47 | 3 08 | 96 | 6 24 | 145 | 9 40 | 47 | 3 08 | 47 | 3.133 | .47 | .031 | 97 | .065 |
| 48 | 3 12 | 97 | 6 28 | 146 | 9 44 | 48 | 3 12 | 48 | 3.200 | .48 | .032 | .98 | .065 |

**TABLE-III ---- *contd.***
**CONVERSION OF ARC TO TIME**

| DEGREES | | | | | | MINUTES | | SECONDS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ° | h m | ° | h m | ° | h m | ′ | m s | ″ | s | ″ | s | ″ | s |
| 147 | 9 48 | 158 | 10 32 | 169 | 11 16 | 49 | 3 16 | 49 | 3.267 | 0.49 | 0.033 | 0.99 | 0.066 |
| 148 | 9 52 | 159 | 10 36 | 170 | 11 20 | 50 | 3 20 | 50 | 3.333 | 0.50 | 0.033 | 1.00 | 0.067 |
| 149 | 9 56 | 160 | 10 40 | 171 | 11 24 | 51 | 3 24 | 51 | 3.400 | | | | |
| 150 | 10 00 | 161 | 10 44 | 172 | 11 28 | 52 | 3 28 | 52 | 3.467 | | | | |
| 151 | 10 04 | 162 | 10 48 | 173 | 11 32 | 53 | 3 32 | 53 | 3.533 | | | | |
| 152 | 10 08 | 163 | 10 52 | 174 | 11 36 | 54 | 3 36 | 54 | 3.600 | | | | |
| 153 | 10 12 | 164 | 10 56 | 175 | 11 40 | 55 | 3 40 | 55 | 3.667 | | | | |
| 154 | 10 16 | 165 | 11 00 | 176 | 11 44 | 56 | 3 44 | 56 | 3.733 | | | | |
| 155 | 10 20 | 166 | 11 04 | 177 | 11 48 | 57 | 3 48 | 57 | 3.800 | | | | |
| 156 | 10 24 | 167 | 11 08 | 178 | 11 52 | 58 | 3 52 | 58 | 3.867 | | | | |
| 157 | 10 28 | 168 | 11 12 | 179 | 11 56 | 59 | 3 56 | 59 | 3.933 | | | | |

**TABLE-IV**
**CONVERSION OF TIME TO ARC**

| | $0^h$ | $1^h$ | $2^h$ | $3^h$ | $4^h$ | $5^h$ | SECONDS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | s | ′ ″ | s | ″ | s | ″ |
| 0 | 0 00 | 15 00 | 30 00 | 45 00 | 60 00 | 75 00 | 0 | 0 00 | 0.00 | 0.00 | 0.50 | 7.50 |
| 1 | 0 15 | 15 15 | 30 15 | 45 15 | 60 15 | 75 15 | 1 | 0 15 | .01 | 0.15 | .51 | 7.65 |
| 2 | 0 30 | 15 30 | 30 30 | 45 30 | 60 30 | 75 30 | 2 | 0 30 | .02 | 0 30 | .52 | 7.80 |
| 3 | 0 45 | 15 45 | 30 45 | 45 45 | 60 45 | 75 45 | 3 | 0 45 | .03 | 0.45 | .53 | 7.95 |
| 4 | 1 00 | 16 00 | 31 00 | 46 00 | 61 00 | 76 00 | 4 | 1 00 | .04 | 0.60 | .54 | 8.10 |
| 5 | 1 15 | 16 15 | 31 15 | 46 15 | 61 15 | 76 15 | 5 | 1 15 | .05 | 0.75 | .55 | 8.25 |
| 6 | 1 30 | 16 30 | 31 30 | 46 30 | 61 30 | 76 30 | 6 | 1 30 | .06 | 0.90 | .56 | 8.40 |
| 7 | 1 45 | 16 45 | 31 45 | 46 45 | 61 45 | 76 45 | 7 | 1 45 | .07 | 1.05 | .57 | 8.55 |
| 8 | 2 00 | 17 00 | 32 00 | 47 00 | 62 00 | 77 00 | 8 | 2 00 | .08 | 1.20 | .58 | 8.70 |
| 9 | 2 15 | 17 15 | 32 15 | 47 15 | 62 15 | 77 15 | 9 | 2 15 | .09 | 1.35 | .59 | 8.85 |
| 10 | 2 30 | 17 30 | 32 30 | 47 30 | 62 30 | 77 30 | 10 | 2 30 | 0.10 | 1.50 | 0.60 | 9.00 |
| 11 | 2 45 | 17 45 | 32 45 | 47 45 | 62 45 | 77 45 | 11 | 2 45 | .11 | 1.65 | .61 | 9.15 |
| 12 | 3 00 | 18 00 | 33 00 | 48 00 | 63 00 | 78 00 | 12 | 3 00 | .12 | 1.80 | .62 | 9.30 |
| 13 | 3 15 | 18 15 | 33 15 | 48 15 | 63 15 | 78 15 | 13 | 3 15 | .13 | 1.95 | .63 | 9.45 |
| 14 | 3 30 | 18 30 | 33 30 | 48 30 | 63 30 | 78 30 | 14 | 3 30 | .14 | 2.10 | .64 | 9.60 |
| 15 | 3 45 | 18 45 | 33 45 | 48 45 | 63 45 | 78 45 | 15 | 3 45 | .15 | 2.25 | .65 | 9.75 |
| 16 | 4 00 | 19 00 | 34 00 | 49 00 | 64 00 | 79 00 | 16 | 4 00 | .16 | 2.40 | .66 | 9.90 |
| 17 | 4 15 | 19 15 | 34 15 | 49 15 | 64 15 | 79 15 | 17 | 4 15 | .17 | 2.55 | .67 | 10.05 |
| 18 | 4 30 | 19 30 | 34 30 | 49 30 | 64 30 | 79 30 | 18 | 4 30 | .18 | 2.70 | .68 | 10.20 |
| 19 | 4 45 | 19 45 | 34 45 | 49 45 | 64 45 | 79 45 | 19 | 4 45 | .19 | 2.85 | .69 | 10.35 |
| 20 | 5 00 | 20 00 | 35 00 | 50 00 | 65 00 | 80 00 | 20 | 5 00 | .20 | 3.00 | 0.70 | 10.50 |
| 21 | 5 15 | 20 15 | 35 15 | 50 15 | 65 15 | 80 15 | 21 | 5 15 | .21 | 3.15 | .71 | 10.65 |
| 22 | 5 30 | 20 30 | 35 30 | 50 30 | 65 30 | 80 30 | 22 | 5 30 | .22 | 3.30 | .72 | 10.80 |
| 23 | 5 45 | 20 45 | 35 45 | 50 45 | 65 45 | 80 45 | 23 | 5 45 | .23 | 3.45 | .73 | 10.95 |
| 24 | 6 00 | 21 00 | 36 00 | 51 00 | 66 00 | 81 00 | 24 | 6 00 | .24 | 3.60 | .74 | 11.10 |
| 25 | 6 15 | 21 15 | 36 15 | 51 15 | 66 15 | 81 15 | 25 | 6 15 | .25 | 3.75 | .75 | 11.25 |
| 26 | 6 30 | 21 30 | 36 30 | 51 30 | 66 30 | 81 30 | 26 | 6 30 | .26 | 3.90 | .76 | 11.40 |
| 27 | 6 45 | 21 45 | 36 45 | 51 45 | 66 45 | 81 45 | 27 | 6 45 | .27 | 4.05 | .77 | 11.55 |
| 28 | 7 00 | 22 00 | 37 00 | 52 00 | 67 00 | 82 00 | 28 | 7 00 | .28 | 4.20 | .78 | 11.70 |
| 29 | 7 15 | 22 15 | 37 15 | 52 15 | 67 15 | 82 15 | 29 | 7 15 | .29 | 4.35 | .79 | 11.85 |
| 30 | 7 30 | 22 30 | 37 30 | 52 30 | 67 30 | 82 30 | 30 | 7 30 | .30 | 4.50 | 0.80 | 12.00 |

**TABLE-IV ---- *contd.***
**CONVERSION OF TIME TO ARC**

| | $0^h$ | $1^h$ | $2^h$ | $3^h$ | $4^h$ | $5^h$ | SECONDS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | s | ′ ″ | s | ″ | s | ″ |
| 31 | 7 45 | 22 45 | 37 45 | 52 45 | 67 45 | 82 45 | 31 | 7 45 | 0.31 | 4.65 | 0.81 | 12.15 |
| 32 | 8 00 | 23 00 | 38 00 | 53 00 | 68 00 | 83 00 | 32 | 8 00 | .32 | 4.80 | .82 | 12.30 |
| 33 | 8 15 | 23 15 | 38 15 | 53 15 | 68 15 | 83 15 | 33 | 8 15 | .33 | 4.95 | .83 | 12.45 |
| 34 | 8 30 | 23 30 | 38 30 | 53 30 | 68 30 | 83 30 | 34 | 8 30 | .34 | 5.10 | .84 | 12.60 |
| 35 | 8 45 | 23 45 | 38 45 | 53 45 | 68 45 | 83 45 | 35 | 8 45 | .35 | 5.25 | .85 | 12.75 |
| 36 | 9 00 | 24 00 | 39 00 | 54 00 | 69 00 | 84 00 | 36 | 9 00 | .36 | 5.40 | .86 | 12.90 |
| 37 | 9 15 | 24 15 | 39 15 | 54 15 | 69 15 | 84 15 | 37 | 9 15 | .37 | 5.55 | .87 | 13.05 |
| 38 | 9 30 | 24 30 | 39 30 | 54 30 | 69 30 | 84 30 | 38 | 9 30 | .38 | 5.70 | .88 | 13.20 |
| 39 | 9 45 | 24 45 | 39 45 | 54 45 | 69 45 | 84 45 | 39 | 9 45 | .39 | 5.85 | .89 | 13.35 |
| 40 | 10 00 | 25 00 | 40 00 | 55 00 | 70 00 | 85 00 | 40 | 10 00 | .40 | 6.00 | .90 | 13.50 |
| 41 | 10 15 | 25 15 | 40 15 | 55 15 | 70 15 | 85 15 | 41 | 10 15 | .41 | 6.15 | .91 | 13.65 |
| 42 | 10 30 | 25 30 | 40 30 | 55 30 | 70 30 | 85 30 | 42 | 10 30 | .42 | 6.30 | .92 | 13.80 |
| 43 | 10 45 | 25 45 | 40 45 | 55 45 | 70 45 | 85 45 | 43 | 10 45 | .43 | 6.45 | .93 | 13.95 |
| 44 | 11 00 | 26 00 | 41 00 | 56 00 | 71 00 | 86 00 | 44 | 11 00 | .44 | 6.60 | .94 | 14.10 |
| 45 | 11 15 | 26 15 | 41 15 | 56 15 | 71 15 | 86 15 | 45 | 11 15 | .45 | 6.75 | .95 | 14.25 |
| 46 | 11 30 | 26 30 | 41 30 | 56 30 | 71 30 | 86 30 | 46 | 11 30 | .46 | 6.90 | .96 | 14.40 |
| 47 | 11 45 | 26 45 | 41 45 | 56 45 | 71 45 | 86 45 | 47 | 11 45 | .47 | 7.05 | .97 | 14.55 |
| 48 | 12 00 | 27 00 | 42 00 | 57 00 | 72 00 | 87 00 | 48 | 12 00 | .48 | 7.20 | .98 | 14.70 |
| 49 | 12 15 | 27 15 | 42 15 | 57 15 | 72 15 | 87 15 | 49 | 12 15 | .49 | 7.35 | 0.99 | 14.85 |
| 50 | 12 30 | 27 30 | 42 30 | 57 30 | 72 30 | 87 30 | 50 | 12 30 | 0.50 | 7.50 | 1.00 | 15.00 |
| 51 | 12 45 | 27 45 | 42 45 | 57 45 | 72 45 | 87 45 | 51 | 12 45 | | | | |
| 52 | 13 00 | 28 00 | 43 00 | 58 00 | 73 00 | 88 00 | 52 | 13 00 | | | | |
| 53 | 13 15 | 28 15 | 43 15 | 58 15 | 73 15 | 88 15 | 53 | 13 15 | | | | |
| 54 | 13 30 | 28 30 | 43 30 | 58 30 | 73 30 | 88 30 | 54 | 13 30 | | h | ° | |
| 55 | 13 45 | 28 45 | 43 45 | 58 45 | 73 45 | 88 45 | 55 | 13 45 | | 6 = | 90 | |
| 56 | 14 00 | 29 00 | 44 00 | 59 00 | 74 00 | 89 00 | 56 | 14 00 | | 12 = | 180 | |
| 57 | 14 15 | 29 15 | 44 15 | 59 15 | 74 15 | 89 15 | 57 | 14 15 | | 18 = | 270 | |
| 58 | 14 30 | 29 30 | 44 30 | 59 30 | 74 30 | 89 30 | 58 | 14 30 | | | | |
| 59 | 14 45 | 29 45 | 44 45 | 59 45 | 74 45 | 89 45 | 59 | 14 45 | | | | |

**TABLE - V**
**CONVERSION OF HOURS, MINUTES AND SECONDS TO DECIMALS OF A DAY**

| | $0^h$ | $1^h$ | $2^h$ | $3^h$ | $4^h$ | $5^h$ | SECONDS | |
|---|---|---|---|---|---|---|---|---|
| m | d | d | d | d | d | d | s | d |
| 0 | 0.000 000 | 0.041 667 | 0.083 333 | 0.125 000 | 0.166 667 | 0.208 333 | 0 | 0.000 000 |
| 1 | .000 694 | .042 361 | .084 028 | .125 694 | .167 361 | .209 028 | 1 | .000 012 |
| 2 | .001 389 | .043 056 | .084 722 | .126 389 | .168 056 | .209 722 | 2 | .000 023 |
| 3 | .002 083 | .043 750 | .085 417 | .127 083 | .168 750 | .210 417 | 3 | .000 035 |
| 4 | .002 778 | .044 444 | .086 111 | .127 778 | .169 444 | .211 111 | 4 | .000 046 |
| 5 | .003 472 | .045 139 | .086 806 | .128 472 | .170 139 | .211 806 | 5 | .000 058 |
| 6 | .004 167 | .045 833 | .087 500 | .129 167 | .170 833 | .212 500 | 6 | .000 069 |
| 7 | .004 861 | .046 528 | .088 194 | .129 861 | .171 528 | .213 194 | 7 | .000 081 |
| 8 | .005 556 | .047 222 | .088 889 | .130 556 | .172 222 | .213 889 | 8 | .000 093 |
| 9 | .006 250 | .047 917 | .089 583 | .131 250 | .172 917 | .214 583 | 9 | .000 104 |
| 10 | 0.006 944 | 0.048 611 | 0.090 278 | 0.131 944 | 0.173 611 | 0.215 278 | 10 | 0.000 116 |
| 11 | .007 639 | .049 306 | .090 972 | 0.132 639 | .174 306 | .215 972 | 11 | .000 127 |

**TABLE - V ---- *contd.***
**CONVERSION OF HOURS, MINUTES AND SECONDS TO DECIMALS OF A DAY**

| | $0^h$ | $1^h$ | $2^h$ | $3^h$ | $4^h$ | $5^h$ | SECONDS | |
|---|---|---|---|---|---|---|---|---|
| m | d | d | d | d | d | d | s | d |
| 12 | 0.008 333 | 0.050 000 | 0.091 667 | 0.133 333 | 0.175 000 | 0.216 667 | 12 | 0.000 139 |
| 13 | .009 028 | .050 694 | .092 361 | .134 028 | .175 694 | .217 361 | 13 | .000 150 |
| 14 | .009 722 | .051 389 | .093 056 | .134 722 | .176 389 | .218 056 | 14 | .000 162 |
| 15 | .010 417 | .052 083 | .093 750 | .135 417 | .177 083 | .218 750 | 15 | .000 174 |
| 16 | .011 111 | .052 778 | .094 444 | .136 111 | .177 778 | .219 444 | 16 | .000 185 |
| 17 | .011 806 | .053 472 | .095 139 | .136 806 | . 178 472 | .220 139 | 17 | .000 197 |
| 18 | .012 500 | .054 167 | .095 833 | .137 500 | .179 167 | .220 833 | 18 | .000 208 |
| 19 | .013 194 | .054 861 | .096 528 | .138 194 | .179 861 | .221 528 | 19 | .000 220 |
| 20 | 0.013 889 | 0.055 556 | 0.097 222 | 0.138 889 | 0.180 556 | 0.222 222 | 20 | 0.000 231 |
| 21 | .014 583 | 056 250 | .097 917 | .139 583 | .181 250 | .222 917 | 21 | .000 243 |
| 22 | .015 278 | .056 944 | .098 611 | .140 278 | .181 944 | .223 611 | 22 | .000 255 |
| 23 | .015 972 | .057 639 | .099 306 | .140 972 | 182 639 | .224 306 | 23 | .000 266 |
| 24 | .016 667 | .058 333 | .100 000 | .141 667 | .183 333 | .225 000 | 24 | .000 278 |
| 25 | .017 361 | .059 028 | .100 694 | .142 361 | .184 028 | .225 694 | 25 | .000 289 |
| 26 | .018 056 | .059 722 | .101 389 | .143 056 | .184 722 | .226 389 | 26 | .000 301 |
| 27 | .018 750 | .060 417 | .102 083 | .143 750 | .185 417 | .227 083 | 27 | .000 312 |
| 28 | .019 444 | .061 111 | .102 778 | .144 444 | .186 111 | .227 778 | 28 | .000 324 |
| 29 | .020 139 | .061 806 | .103 472 | .145 139 | .186 806 | .228 472 | 29 | .000 336 |
| 30 | 0.020 833 | 0.062 500 | 0.104 167 | 0.145 833 | 0.187 500 | 0.229 167 | 30 | 0.000 347 |
| 31 | .021 528 | .063 194 | .104 861 | .146 528 | .188 194 | .229 861 | 31 | .000 359 |
| 32 | .022 222 | .063 889 | .105 556 | .147 222 | .188 889 | .230 556 | 32 | .000370 |
| 33 | .022 917 | .064 583 | .106 250 | .147 917 | .189 583 | .231 250 | 33 | .000 382 |
| 34 | .023 611 | .065 278 | .106 944 | .148 611 | .190 278 | .231 944 | 34 | .000 394 |
| 35 | .024 306 | .065 972 | .107 639 | .149 306 | .190 972 | .232 639 | 35 | .000 405 |
| 36 | .025 000 | .066 667 | .108 333 | .150 000 | .191 667 | .233 333 | 36 | .000 417 |
| 37 | .025 694 | .067 361 | .109 028 | .150 694 | .192 361 | .234 028 | 37 | .000 428 |
| 38 | .026 389 | .068 056 | .109 722 | .151 389 | .193 056 | .234 722 | 38 | .000 440 |
| 39 | .027 083 | .068 750 | .110 417 | .152 083 | .193 750 | .235 417 | 39 | .000 451 |
| 40 | 0.027 778 | 0.069 444 | 0.111 111 | 0.152 778 | 0.194 444 | 0.236 111 | 40 | 0.000 463 |
| 41 | .028 472 | .070 139 | .111 806 | .153 472 | .195 139 | .236 806 | 41 | .000 475 |
| 42 | .029 167 | .070 833 | .112 500 | .154 167 | .195 833 | .237 500 | 42 | .000 486 |
| 43 | .029 861 | .071 528 | .113 194 | .154 861 | .196 528 | .238 194 | 43 | .000 498 |
| 44 | .030 556 | .072 222 | .113 889 | .155 556 | .197 222 | .238 889 | 44 | .000 509 |
| 45 | .031 250 | .072 917 | .114 583 | .156 250 | .197 917 | .239 583 | 45 | .000 521 |
| 46 | .031 944 | .073 611 | .115 278 | .156 944 | .198 611 | .240 278 | 46 | .000 532 |
| 47 | .032 639 | .074 306 | .115 972 | .157 639 | .199 306 | .240 972 | 47 | .000 544 |
| 48 | .033 333 | .075 000 | .116 667 | .158 333 | .200 000 | .241 667 | 48 | .000 556 |
| 49 | .034 028 | .075 694 | .117 361 | .159 028 | .200 694 | .242 361 | 49 | .000 567 |
| 50 | 0.034 722 | 0.076 389 | 0.118 056 | 0.159 722 | 0.201 389 | 0.243 056 | 50 | 0.000 579 |
| 51 | .035 417 | .077 083 | .118 750 | .160 417 | .202 083 | .243 750 | 51 | .000 590 |
| 52 | .036 111 | .077 778 | .119 444 | .161 111 | .202 778 | .244 444 | 52 | .000 602 |
| 53 | .036 806 | .078 472 | .120 139 | .161 806 | .203 472 | .245 139 | 53 | .000 613 |
| 54 | .037 500 | .079 167 | .120 833 | .162 500 | .204 167 | .245 833 | 54 | .000 625 |
| 55 | .038 194 | .079 861 | .121 528 | .163 194 | .204 861 | .246 528 | 55 | .000 637 |
| 56 | .038 889 | .080 556 | .122 222 | .163 889 | .205 556 | .247 222 | 56 | .000 648 |
| 57 | .039 583 | .081 250 | .122 917 | .164 583 | .206 250 | .247 917 | 57 | .000 660 |
| 58 | .040 278 | .081 944 | .123 611 | .165 278 | .206 944 | .248 611 | 58 | .000 671 |
| 59 | 0.040 972 | 0.082 639 | 0.124 306 | 0.165 972 | 0.207 639 | 0.249 306 | 59 | 0.000 683 |

**TABLE - V ---- *contd.***

**CONVERSION OF HOURS, MINUTES AND SECONDS TO DECIMALS OF A DAY**

| | $6^h$ | $7^h$ | $8^h$ | $9^h$ | $10^h$ | $11^h$ | SECONDS | |
|---|---|---|---|---|---|---|---|---|
| m | d | d | d | d | d | d | s | d |
| 0 | 0.250 000 | 0.291 667 | 0.333 333 | 0.375 000 | 0.416 667 | 0.458 333 | 0 | 0.000 000 |
| 1 | .250 694 | .292 361 | .334 028 | .375 694 | . 417 361 | .459 028 | 1 | .000 012 |
| 2 | .251 389 | .293 056 | .334 722 | .376 389 | .418 056 | .459 722 | 2 | .000 023 |
| 3 | .252 083 | .293 750 | .335 417 | .377 083 | .418 750 | .460 417 | 3 | .000 035 |
| 4 | .252 778 | .294 444 | .336 111 | .377 778 | .419 444 | .461 111 | 4 | .000 046 |
| 5 | .253 472 | .295 139 | .336 806 | .378 472 | .420 139 | .461 806 | 5 | .000 058 |
| 6 | .254 167 | .295 833 | .337 500 | .379 167 | .420 833 | .462 500 | 6 | .000 069 |
| 7 | .254 861 | .296 528 | 338 194 | .379 861 | .421 528 | . 463 194 | 7 | .000 081 |
| 8 | .255 556 | .297 222 | .338 889 | .380 556 | .422 222 | . 463 889 | 8 | .000 093 |
| 9 | .256 250 | .297 917 | .339 583 | .381 250 | .422 917 | .464 583 | 9 | .000 104 |
| 10 | 0.256 944 | 0.298 611 | 0.340 278 | 0.381 944 | 0.423 611 | 0.465 278 | 10 | 0.000 116 |
| 11 | .257 639 | .299 306 | .340 972 | .382 639 | .424 306 | .465 972 | 11 | .000 127 |
| 12 | .258 333 | .300 000 | .341 667 | .383 333 | .425 000 | .466 667 | 12 | .000 139 |
| 13 | .259 028 | .300 694 | .342 361 | 384 028 | .425 694 | .467 361 | 13 | .000 150 |
| 14 | .259 722 | .301 389 | .343 056 | .384 722 | .426 389 | .468 056 | 14 | .000 162 |
| 15 | .260 417 | .302 083 | .343 750 | .385 417 | .427 083 | .468 750 | 15 | .000 174 |
| 16 | .261 111 | .302 778 | .344 444 | .386 111 | .427 778 | .469 444 | 16 | .000 185 |
| 17 | .261 806 | .303 472 | .345 139 | .386 806 | .428 472 | .470 139 | 17 | .000 197 |
| 18 | .262 500 | .304 167 | .345 833 | .387 500 | .429 167 | .470 833 | 18 | .000 208 |
| 19 | .263 194 | .304 861 | .346 528 | .388 194 | .429 861 | .471 528 | 19 | .000 220 |
| 20 | 0.263 889 | 0.305 556 | 0.347 222 | 0.388 889 | 0.430 556 | 0.472 222 | 20 | 0.000 231 |
| 21 | .264 583 | .306 250 | .347 917 | .389 583 | .431 250 | .472 917 | 21 | .000 243 |
| 22 | .265 278 | .306 944 | .348 611 | .390 278 | .431 944 | .473 661 | 22 | .000 255 |
| 23 | .265 972 | .307 639 | .349 306 | .390 972 | .432 639 | .474 306 | 23 | .000 266 |
| 24 | .266 667 | .308 383 | .350 000 | .391 667 | .433 333 | .475 000 | 24 | .000 278 |
| 25 | .267 361 | .309 028 | .350 694 | .392 361 | .434 028 | .475 694 | 25 | .000289 |
| 26 | .268 056 | .309 722 | .351 389 | .393 056 | .434 722 | .476 389 | 26 | .000 301 |
| 27 | .268 750 | .310 417 | .352 083 | .393 750 | .435 417 | .477 083 | 27 | .000 312 |
| 28 | .269 444 | .311 111 | .352 778 | .394 444 | .436 111 | .477 778 | 28 | .000 324 |
| 29 | .270 139 | .311 806 | .353 472 | .395 139 | .436 806 | .478 472 | 29 | .000 336 |
| 30 | 0.270 833 | 0.312 500 | 0.354 167 | 0.395 833 | 0.437 500 | 0.479 167 | 30 | 0.000 347 |
| 31 | .271 528 | .313 194 | .354 861 | .396 528 | .438 194 | .479 861 | 31 | .000 359 |
| 32 | .272 222 | .313 889 | .355 556 | .397 222 | .438 889 | .480 556 | 32 | .000 370 |
| 33 | .272 917 | .314 583 | .356 250 | .397 917 | .439 583 | .481 250 | 33 | .000 382 |
| 34 | .273 611 | .315 278 | .356 944 | .398 611 | .440 278 | .481 944 | 34 | .000 394 |
| 35 | .274 306 | .315 972 | .357 639 | .399 306 | .440 972 | .482 639 | 35 | .000 405 |
| 36 | .275 000 | .316 667 | .358 333 | .400 000 | .441 667 | .483 333 | 36 | .000 417 |
| 37 | .275 694 | .317 361 | .359 028 | .400 694 | .442 361 | .484 028 | 37 | .000 428 |
| 38 | 276 389 | .318 056 | .359 722 | .401 389 | .443 056 | .484 722 | 38 | .000 440 |
| 39 | .277 083 | .318 750 | .360 417 | .402 083 | .443 750 | .485 417 | 39 | .000 451 |
| 40 | 0.277 778 | 0.319 444 | 0.361 111 | 0.402 778 | 0.444 444 | 0.486 111 | 40 | 0.000 463 |
| 41 | .278 472 | .320 139 | .361 806 | .403 472 | .445 139 | .486 806 | 41 | .000 475 |
| 42 | 279 167 | .320 833 | .362 500 | .404 167 | .445 833 | .487 500 | 42 | .000 486 |
| 43 | .279 861 | .321 528 | .363 194 | .404 861 | .446 528 | .488 194 | 43 | .000 498 |
| 44 | .280 556 | .322 222 | .363 889 | .405 556 | .447 222 | .488 889 | 44 | .000 509 |
| 45 | .281 250 | .322 917 | .364 583 | .406 250 | .447 917 | .489 583 | 45 | .000 521 |
| 46 | 0.281 944 | 0.323 611 | 0.365 278 | 0.406 944 | 0.448 611 | 0.490 278 | 46 | 0.000 532 |

**TABLE - V ---- *contd.***
**CONVERSION OF HOURS, MINUTES AND SECONDS TO DECIMALS OF A DAY**

| | $6^{h}$ | $7^{h}$ | $8^{h}$ | $9^{h}$ | $10^{h}$ | $11^{h}$ | SECONDS | |
|---|---|---|---|---|---|---|---|---|
| m | d | d | d | d | d | d | s | d |
| 47 | 0.282 639 | 0.324 306 | 0.365 972 | 0.407 639 | 0.449 306 | 0.490 972 | 47 | 0.000 544 |
| 48 | .283 333 | .325 000 | .366 667 | .408 333 | .450 000 | .491 667 | 48 | .000 556 |
| 49 | .284 028 | .325 694 | .367 361 | .409 028 | .450 694 | .492 361 | 49 | .000 567 |
| 50 | 0.284 722 | 0.326 389 | 0.368 056 | 0.409 722 | 0.451 389 | 0.493 056 | 50 | 0.000 579 |
| 51 | .285 417 | .327 083 | .368 750 | .410 417 | .452 083 | .493 750 | 51 | .000 590 |
| 52 | .286 111 | .327 778 | .369 444 | .411 111 | .452 778 | .494 444 | 52 | .000 602 |
| 53 | .286 806 | .328 472 | . 370 139 | .411 806 | .453 472 | .495 139 | 53 | .000 613 |
| 54 | .287 500 | .329 167 | .370 833 | .412 500 | .454 167 | .495 833 | 54 | .000 625 |
| 55 | .288 194 | .329 861 | .371 528 | .413 194 | .454 861 | .496 528 | 55 | .000 637 |
| 56 | .288 889 | .330 556 | .372 222 | .413 889 | .455 556 | .497 222 | 56 | .000 648 |
| 57 | .289 583 | .331 250 | .372 917 | .414 583 | .456 250 | .497 917 | 57 | .000 660 |
| 58 | .290 278 | .331 944 | .373 611 | .415 278 | .456 944 | .498 611 | 58 | .000 671 |
| 59 | 0.290 972 | 0.332 639 | 0.374 306 | 0.415 972 | 0.457 639 | 0.499 306 | 59 | 0.000 683 |

**TABLE - VI**
**CONVERSION OF MINUTES AND SECONDS TO DECIMALS OF A DEGREE**

| | 0′ | 1′ | 2′ | 3′ | 4′ | 5′ | | |
|---|---|---|---|---|---|---|---|---|
| ″ | ° | ° | ° | ° | ° | ° | ″ | ° |
| 0 | 0.00000 | 0.01667 | 0.03333 | 0.05000 | 0.06667 | 0.08333 | 0 | 0.0 |
| 1 | 0028 | 1694 | 3361 | 5028 | | 8361 | 6 | 0.1 |
| 2 | 0056 | 1722 | 3389 | 5056 | 6722 | 8389 | 12 | 0.2 |
| 3 | 0083 | 1750 | 3417 | 5083 | 6750 | 8417 | 18 | 0.3 |
| 4 | 0111 | 1778 | 3444 | 5111 | 6778 | 8444 | 24 | 0.4 |
| 5 | 0139 | 1806 | 3472 | 5139 | 6806 | 8472 | 30 | 0.5 |
| 6 | 0167 | 1833 | 3500 | 5167 | 6833 | 8500 | 36 | 0.6 |
| 7 | 0194 | 1861 | 3528 | 5194 | 6861 | 8528 | 42 | 0.7 |
| 8 | 0222 | 1889 | 3556 | 5222 | 6889 | 8556 | 48 | 0.8 |
| 9 | 0250 | 1917 | 3583 | 5250 | 6917 | 8583 | 54 | 0.9 |
| 10 | 0.00278 | 0.01944 | 0.03611 | 0.05278 | 0.06944 | 0.08611 | | |
| 11 | 0306 | 1972 | 3639 | 5306 | 6972 | 8639 | | |
| 12 | 0333 | 2000 | 3667 | 5333 | 7000 | 8667 | | |
| 13 | 0361 | 2028 | 3694 | 5361 | 7028 | 8694 | | |
| 14 | 0389 | 2056 | 3722 | 5389 | 7056 | 8722 | | |
| 15 | 0417 | 2083 | 3750 | 5417 | 7083 | 8750 | | |
| 16 | 0444 | 2111 | 3778 | 5444 | 7111 | 8778 | | |
| 17 | 0472 | 2139 | 3806 | 5472 | 7139 | 8806 | | |
| 18 | 0500 | 2167 | 3833 | 5500 | 7167 | 8833 | | |
| 19 | 0528 | 2194 | 3861 | 5528 | 7194 | 8861 | | |
| 20 | 0.00556 | 0.02222 | 0.03889 | 0.05556 | 0.07222 | 0.08889 | | |
| 21 | 0583 | 2250 | 3917 | 5583 | 7250 | 8917 | | |
| 22 | 0611 | 2278 | 3944 | 5611 | 7278 | 8944 | | |
| 23 | 0639 | 2306 | 3972 | 5639 | 7306 | 8972 | | |
| 24 | 0667 | 2333 | 4000 | 5667 | 7333 | 9000 | | |
| 25 | 0.00694 | 0.02361 | 0.04028 | 0.05694 | 0.07361 | 0.09028 | | |

## TABLE - VI ---- *contd.*
## CONVERSION OF MINUTES AND SECONDS TO DECIMALS OF A DEGREE

| | 0′ | 1′ | 2′ | 3′ | 4′ | 5′ |
|---|---|---|---|---|---|---|
| ″ | ° | ° | ° | ° | ° | ° |
| 26 | 0.00722 | 0.02389 | 0.04056 | 0.05722 | 0.07389 | 0.09056 |
| 27 | 0750 | 2417 | 4083 | 5750 | 7417 | 9083 |
| 28 | 0778 | 2444 | 4111 | 5778 | 7444 | 9111 |
| 29 | 0806 | 2472 | 4139 | 5806 | 7472 | 9139 |
| 30 | 0.00833 | 0.02500 | 0.04167 | 0.05833 | 0.07500 | 0.09167 |
| 31 | 0861 | 2528 | 4194 | 5861 | 7528 | 9194 |
| 32 | 0889 | 2556 | 4222 | 5889 | 7556 | 9222 |
| 33 | 0917 | 2583 | 4250 | 5917 | 7583 | 9250 |
| 34 | 0944 | 2611 | 4278 | 5944 | 7611 | 9278 |
| 35 | 0972 | 2639 | 4306 | 5972 | 7639 | 9306 |
| 36 | 1000 | 2667 | 4333 | 6000 | 7667 | 9333 |
| 37 | 1028 | 2694 | 4361 | 6028 | 7694 | 9361 |
| 38 | 1056 | 2722 | 4389 | 6056 | 7722 | 9389 |
| 39 | 1083 | 2750 | 4417 | 6083 | 7750 | 9417 |
| 40 | 0.01111 | 0.02778 | 0.04444 | 0.06111 | 0.07778 | 0.09444 |
| 41 | 1139 | 2806 | 4472 | 6139 | 7806 | 9472 |
| 42 | 1167 | 2833 | 4500 | 6167 | 7833 | 9500 |
| 43 | 1194 | 2861 | 4528 | 6194 | 7861 | 9528 |
| 44 | 1222 | 2889 | 4556 | 6222 | 7889 | 9556 |
| 45 | 1250 | 2917 | 4583 | 6250 | 7917 | 9583 |
| 46 | 1278 | 2944 | 4611 | 6278 | 7944 | 9611 |
| 47 | 1306 | 2972 | 4639 | 6306 | 7972 | 9639 |
| 48 | 1333 | 3000 | 4667 | 6333 | 8000 | 9667 |
| 49 | 1361 | 3028 | 4694 | 6361 | 8028 | 9694 |
| 50 | 0.01389 | 0.03056 | 0.04722 | 0.06389 | 0.08056 | 0.09722 |
| 51 | 1417 | 3083 | 4750 | 6417 | 8083 | 9750 |
| 52 | 1444 | 3111 | 4778 | 6444 | 8111 | 9778 |
| 53 | 1472 | 3139 | 4806 | 6472 | 8139 | 9806 |
| 54 | 1500 | 3167 | 4833 | 6500 | 8167 | 9833 |
| 55 | 1528 | 3194 | 4861 | 6528 | 8194 | 9861 |
| 56 | 1556 | 3222 | 4889 | 6556 | 8222 | 9889 |
| 57 | 1583 | 3250 | 4917 | 6583 | 8250 | 9917 |
| 58 | 1611 | 3278 | 4944 | 6611 | 8278 | 9944 |
| 59 | 0.01639 | 0.03306 | 0.04972 | 0.06639 | 0.08306 | 0.09972 |

In units of the fifth decimal of a Degree.

| ″ | ° |
|---|---|
| 0.00 | |
| | 0 |
| .01 | |
| | 1 |
| .05 | |
| | 2 |
| .09 | |
| | 3 |
| .12 | |
| | 4 |
| .16 | |
| | 5 |
| .19 | |
| | 6 |
| .23 | |
| | 7 |
| .26 | |
| | 8 |
| .30 | |
| | 9 |
| .34 | |
| | 10 |
| .37 | |
| | 11 |
| .41 | |
| | 12 |
| .45 | |
| | 13 |
| .48 | |
| | 14 |
| .52 | |
| | 15 |
| .55 | |
| | 16 |
| .59 | |
| | 17 |
| .62 | |
| | 18 |
| .66 | |
| | 19 |
| .70 | |
| | 20 |
| .73 | |
| | 21 |
| .77 | |
| | 22 |
| .81 | |
| | 23 |
| .84 | |
| | 24 |
| .88 | |
| | 25 |
| .91 | |
| | 26 |
| .95 | |
| | 27 |
| 0.98 | |
| | 28 |
| 1.00 | |

*In critical cases ascend*

## TABLE - VII
## INTERPOLATION COEFFICIENTS

| *n* | *B″* | *E₀″* | *E₁″* | n | *B″* | *E₀″* | *E₁″* |
|---|---|---|---|---|---|---|---|
| 0.00 | 0.00000 | 0.00000 | 0.00000 | 0.05 | 0.01188 | 0.01544 | 0.00831 |
| .01 | .00248 | .00328 | .00167 | .06 | 0.01410 | 0.01824 | 0.00996 |
| .02 | .00490 | .00647 | .00333 | .07 | .01628 | .02094 | .01161 |
| .03 | .00728 | .00955 | .00500 | .08 | .01840 | .02355 | .01325 |
| .04 | .00960 | .01254 | .00666 | .09 | .02048 | .02607 | .01488 |
| 0.05 | 0.01188 | 0.01544 | 0.00831 | 0.10 | 0.02250 | 0.02850 | 0.01650 |

**TABLE - VII ---- *contd.***
**INTERPOLATION COEFFICIENTS**

| *n* | *B″* | *E₀″* | *E₁″* | n | *B″* | *E₀″* | *E₁″* |
|---|---|---|---|---|---|---|---|
| 0.10 | 0.02250 | 0.02850 | 0.01650 | 0.55 | 0.06188 | 0.05981 | 0.06394 |
| .11 | .02448 | .03084 | .01811 | .56 | 0.06160 | 0.05914 | 0.06406 |
| .12 | .02640 | .03309 | .01971 | .57 | .06128 | .05842 | .06413 |
| .13 | .02828 | .03525 | .02130 | .58 | .06090 | .05765 | .06415 |
| .14 | .03010 | .03732 | .02288 | .59 | .06048 | .05685 | .06410 |
| .15 | .03188 | .03931 | .02444 | 0.60 | 0.06000 | 0.05600 | 0.06400 |
| .16 | .03360 | .04122 | .02598 | .61 | .05948 | .05511 | .06384 |
| .17 | .03528 | .04304 | .02751 | .62 | .05890 | .05419 | .06361 |
| .18 | .03690 | .04477 | .02903 | .63 | .05828 | .05322 | .06333 |
| .19 | .03848 | .04643 | .03052 | .64 | .05760 | .05222 | .06298 |
| 0.20 | 0.04000 | 0.04800 | 0.03200 | .65 | .05688 | .05119 | .06256 |
| .21 | .04148 | .04949 | .03346 | .66 | .05610 | .05012 | .06208 |
| .22 | .04290 | .05091 | .03489 | .67 | .05528 | .04901 | .06154 |
| .23 | .04428 | .05224 | .03631 | .68 | .05440 | .04787 | .06093 |
| .24 | .04560 | .05350 | .03770 | .69 | .05348 | .04670 | .06025 |
| .25 | .04688 | .05469 | .03906 | 0.70 | 0.05250 | 0.04550 | 0.05950 |
| .26 | .04810 | .05580 | .04040 | .71 | .05148 | .04427 | .05868 |
| .27 | .04928 | .05683 | .04172 | .72 | .05040 | .04301 | .05779 |
| .28 | .05040 | .05779 | .04301 | .73 | .04928 | .04172 | .05683 |
| .29 | .05148 | .05868 | .04427 | .74 | .04810 | .04040 | .05580 |
| 0.30 | 0.05250 | 0.05950 | 0.04550 | .75 | .04688 | .03906 | .05469 |
| .31 | .05348 | .06025 | .04670 | .76 | .04560 | .03770 | .05350 |
| .32 | .05440 | .06093 | .04787 | .77 | .04428 | .03631 | .05224 |
| .33 | .05528 | .06154 | .04901 | .78 | .04290 | .03489 | .05091 |
| .34 | .05610 | .06208 | .05012 | .79 | .04148 | .03346 | .04949 |
| .35 | .05688 | .06256 | .05119 | 0.80 | 0.04000 | 0.03200 | 0.04800 |
| .36 | .05760 | .06298 | .05222 | .81 | . 03848 | .03052 | .04643 |
| .37 | .05828 | .06333 | .05322 | .82 | .03690 | .02903 | .04477 |
| .38 | .05890 | .06361 | .05419 | .83 | .03528 | .02751 | .04304 |
| .39 | .05948 | .06384 | .05511 | .84 | .03360 | .02598 | .04122 |
| 0.40 | 0.06000 | 0.06400 | 0.05600 | .85 | .03188 | .02444 | .03931 |
| .41 | .06048 | .06410 | .05685 | .86 | .03010 | .02288 | .03732 |
| .42 | .06090 | .06415 | .05765 | .87 | .02828 | .02130 | .03525 |
| .43 | .06128 | .06413 | .05842 | .88 | .02640 | .01971 | .03309 |
| .44 | .06160 | .06406 | .05914 | .89 | .02448 | .01811 | .03084 |
| .45 | .06188 | .06394 | .05981 | 0.90 | 0.02250 | 0.01650 | 0.02850 |
| .46 | .06210 | .06376 | .06044 | .91 | .02048 | .01488 | .02607 |
| .47 | .06228 | .06352 | .06103 | .92 | .01840 | .01325 | .02355 |
| .48 | .06240 | .06323 | .06157 | .93 | .01628 | .01161 | .02094 |
| .49 | .06248 | .06289 | .06206 | .94 | .01410 | .00996 | .01824 |
| 0.50 | 0.06250 | 0.06250 | 0.06250 | .95 | .01188 | .00831 | .01544 |
| .51 | .06248 | .06206 | .06289 | .96 | .00960 | .00666 | .01254 |
| .52 | .06240 | .06157 | .06323 | .97 | .00728 | .00500 | .00955 |
| .53 | .06228 | .06103 | .06352 | .98 | .00490 | .00333 | .00647 |
| .54 | .06210 | .06044 | .06376 | 0.99 | .00248 | .00167 | .00328 |
| 0.55 | 0.06188 | 0.05981 | 0.06394 | 1.00 | 0.00000 | 0.00000 | 0.00000 |

*N.B.* ï The coefficients are all *negative*. For details about Besselôs and Everettôs interpolation formula, please *see* Explanation

**TABLE - VIII**
**EVERETT COEFFICIENTS OF THE SECOND DIFFERENCES**
(*The coefficients are all negative*)

| $n$ | $E_0''$ | $E_1''$ | | $n$ | $E_0''$ | $E_1''$ | | $n$ | $E_0''$ | $E_1''$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.000 | | | 1.000 | 0.050 | | | 0.950 | 0.100 | | | 0.900 |
| | 0.0002 | 0.0001 | | | 0.0156 | 0.0084 | | | 0.0286 | 0.0166 | |
| .001 | | | 0.999 | .051 | | | .949 | .101 | | | .899 |
| | .0005 | .0002 | | | .0159 | .0086 | | | .0289 | .0167 | |
| .002 | | | .998 | .052 | | | .948 | .102 | | | .898 |
| | .0008 | .0004 | | | .0161 | .0087 | | | .0291 | .0169 | |
| .003 | | | .997 | .053 | | | .947 | .103 | | | .897 |
| | .0012 | .0006 | | | .0164 | .0089 | | | .0293 | .0171 | |
| .004 | | | .996 | .054 | | | .946 | .104 | | | .896 |
| | .0015 | .0007 | | | .0167 | .0091 | | | .0296 | .0172 | |
| .005 | | | .995 | .055 | | | .945 | .105 | | | .895 |
| | .0018 | .0009 | | | .0170 | .0092 | | | .0298 | .0174 | |
| .006 | | | .994 | .056 | | | .944 | .106 | | | .894 |
| | .0021 | .0011 | | | .0173 | .0094 | | | .0300 | .0175 | |
| .007 | | | .993 | .057 | | | .943 | .107 | | | .893 |
| | .0025 | .0012 | | | .0175 | .0096 | | | .0303 | .0177 | |
| .008 | | | .992 | .058 | | | .942 | .108 | | | .892 |
| | .0028 | .0014 | | | .0178 | .0097 | | | .0305 | .0179 | |
| .009 | | | .991 | .059 | | | .941 | .109 | | | .891 |
| | .0031 | .0016 | | | .0181 | .0099 | | | .0307 | .0180 | |
| .010 | | | .990 | .060 | | | .940 | .110 | | | .890 |
| | .0034 | .0017 | | | .0184 | .0100 | | | .0310 | .0182 | |
| .011 | | | .989 | .061 | | | .939 | .111 | | | .889 |
| | .0038 | .0019 | | | .0186 | .0102 | | | .0312 | .0184 | |
| .012 | | | .988 | .062 | | | .938 | .112 | | | .888 |
| | .0041 | .0021 | | | .0189 | .0104 | | | .0314 | .0185 | |
| .013 | | | .987 | .063 | | | .937 | .113 | | | .887 |
| | .0044 | .0022 | | | .0192 | .0105 | | | .0316 | .0187 | |
| .014 | | | .986 | .064 | | | .936 | .114 | | | .886 |
| | .0047 | .0024 | | | .0195 | .0107 | | | .0319 | .0188 | |
| .015 | | | .985 | .065 | | | .935 | .115 | | | .885 |
| | .0050 | .0026 | | | .0197 | .0109 | | | .0321 | .0190 | |
| .016 | | | .984 | .066 | | | .934 | .116 | | | .884 |
| | .0054 | .0027 | | | .0200 | .0110 | | | .0323 | .0192 | |
| .017 | | | .983 | .067 | | | .933 | .117 | | | .883 |
| | .0057 | .0029 | | | .0203 | .0112 | | | .0325 | .0193 | |
| .018 | | | .982 | .068 | | | .932 | .118 | | | .882 |
| | .0060 | .0031 | | | .0205 | .0114 | | | .0328 | .0195 | |
| .019 | | | .981 | .069 | | | .931 | .119 | | | .881 |
| | .0063 | .0032 | | | .0208 | .0115 | | | .0330 | .0196 | |
| .020 | | | .980 | .070 | | | .930 | .120 | | | .880 |
| | .0066 | .0034 | | | .0211 | .0117 | | | .0332 | .0198 | |
| .021 | | | .979 | .071 | | | .929 | .121 | | | .879 |
| | .0069 | .0036 | | | .0213 | .0119 | | | .0334 | .0200 | |
| .022 | | | .978 | .072 | | | .928 | .122 | | | .878 |
| | .0072 | .0037 | | | .0216 | .0120 | | | .0336 | .0201 | |
| .023 | | | .977 | .073 | | | .927 | .123 | | | .877 |
| | .0076 | .0039 | | | .0219 | .0122 | | | .0339 | .0203 | |
| .024 | | | .976 | .074 | | | .926 | .124 | | | .876 |
| | .0079 | .0041 | | | .0221 | .0123 | | | .0341 | .0204 | |
| .025 | | | .975 | .075 | | | .925 | .125 | | | .875 |
| | .0082 | .0042 | | | .0224 | .0125 | | | .0343 | .0206 | |
| .026 | | | .974 | .076 | | | .924 | .126 | | | .874 |
| | .0085 | .0044 | | | .0226 | .0127 | | | .0345 | .0207 | |
| .027 | | | .973 | .077 | | | .923 | .127 | | | .873 |
| | .0088 | .0046 | | | .0229 | .0128 | | | .0347 | .0209 | |
| .028 | | | .972 | .078 | | | .922 | .128 | | | .872 |
| | .0091 | .0047 | | | .0232 | .0130 | | | .0349 | .0211 | |
| .029 | | | .971 | .079 | | | .921 | .129 | | | .871 |
| | .0094 | .0049 | | | .0234 | .0132 | | | .0351 | .0212 | |
| .030 | | | .970 | .080 | | | .920 | .130 | | | .870 |
| | .0097 | .0051 | | | .0237 | .0133 | | | .0354 | .0214 | |
| .031 | | | .969 | .081 | | | .919 | .131 | | | .869 |
| | .0100 | .0052 | | | .0239 | .0135 | | | .0356 | .0215 | |
| .032 | | | .968 | .082 | | | .918 | .132 | | | .868 |
| | .0103 | .0054 | | | .0242 | .0137 | | | .0358 | .0217 | |
| .033 | | | .967 | .083 | | | .917 | .133 | | | .867 |
| | .0106 | .0056 | | | .0244 | .0138 | | | .0360 | .0219 | |
| .034 | | | .966 | .084 | | | .916 | .134 | | | .866 |
| | .0109 | .0057 | | | .0247 | .0140 | | | .0362 | .0220 | |
| .035 | | | .965 | .085 | | | .915 | .135 | | | .865 |
| | .0112 | .0059 | | | .0249 | .0141 | | | .0364 | .0222 | |
| .036 | | | .964 | .086 | | | .914 | .136 | | | .864 |
| | .0115 | .0061 | | | .0252 | .0143 | | | .0366 | .0223 | |
| .037 | | | .963 | .087 | | | .913 | .137 | | | .863 |
| | .0118 | .0062 | | | .0255 | .0145 | | | .0368 | .0225 | |
| .038 | | | .962 | .088 | | | .912 | .138 | | | .862 |
| | .0121 | .0064 | | | .0257 | .0146 | | | .0370 | .0226 | |
| .039 | | | .961 | .089 | | | .911 | .139 | | | .861 |
| | .0124 | .0066 | | | .0259 | .0148 | | | .0372 | .0228 | |
| .040 | | | .960 | .090 | | | .910 | .140 | | | .860 |
| | .0127 | .0067 | | | .0262 | .0150 | | | .0374 | .0230 | |
| .041 | | | .959 | .091 | | | .909 | .141 | | | .859 |
| | .0130 | .0069 | | | .0264 | .0151 | | | .0376 | .0231 | |
| .042 | | | .958 | .092 | | | .908 | .142 | | | .858 |
| | .0133 | .0071 | | | .0267 | .0153 | | | .0378 | .0233 | |
| .043 | | | .957 | .093 | | | .907 | .143 | | | .857 |
| | .0136 | .0072 | | | .0269 | .0154 | | | .0380 | .0234 | |
| .044 | | | .956 | .094 | | | .906 | .144 | | | .856 |
| | .0139 | .0074 | | | .0272 | .0156 | | | .0382 | .0236 | |
| .045 | | | .955 | .095 | | | .905 | .145 | | | .855 |
| | .0141 | .0076 | | | .0274 | .0158 | | | .0384 | .0237 | |
| .046 | | | .954 | .096 | | | . 904 | .146 | | | .854 |
| | .0144 | .0077 | | | .0277 | .0159 | | | .0386 | .0239 | |
| .047 | | | .953 | .097 | | | .903 | .147 | | | .853 |
| | .0147 | .0079 | | | .0279 | .0161 | | | .0388 | .0240 | |
| .048 | | | .952 | .098 | | | .902 | .148 | | | .852 |
| | .0150 | .0081 | | | .0281 | .0163 | | | .0390 | .0242 | |
| .049 | | | .951 | .099 | | | .901 | .149 | | | .851 |
| | 0.0153 | 0.0082 | | | 0.0284 | 0.0164 | | | 0.0392 | 0.0244 | |
| 0.050 | | | 0.950 | 0.100 | | | 0.900 | 0.150 | | | 0.850 |
| | $E_1''$ | $E_0''$ | $n$ | | $E_1''$ | $E_0''$ | $n$ | | $E_1''$ | $E_0''$ | $n$ |

Formula : $f_n = f_0 + n\,\Delta_{1/2}' + E_0''\Delta_0'' + E_1''\Delta_1''$

**TABLE - VIII ---- *contd.***

**EVERETT COEFFICIENTS OF THE SECOND DIFFERENCES**

(*The coefficients are all negative*)

| *n* | $E_0''$ | $E_1''$ | | *n* | $E_0''$ | $E_1''$ | | *n* | $E_0''$ | $E_1''$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.150 | 0.0394 | 0.0245 | 0.850 | 0.200 | 0.0482 | 0.0321 | 0.800 | 0.300 | 0.0597 | 0.0457 | 0.700 |
| .151 | .0396 | .0247 | .849 | .202 | .0485 | .0324 | .798 | .304 | .0600 | .0462 | .696 |
| .152 | .0398 | .0248 | .848 | .204 | .0488 | .0327 | .796 | .308 | .0602 | .0467 | .692 |
| .153 | .0400 | .0250 | .847 | .206 | .0491 | .0330 | .794 | .312 | .0605 | .0472 | .688 |
| .154 | .0402 | .0251 | .846 | .208 | .0493 | .0333 | .792 | .316 | .0608 | .0476 | .684 |
| .155 | .0404 | .0253 | .845 | .210 | .0496 | .0336 | .790 | .320 | .0611 | .0481 | .680 |
| .156 | .0406 | .0254 | .844 | .212 | .0499 | .0339 | .788 | .324 | .0613 | .0486 | .676 |
| .157 | .0407 | .0256 | .843 | .214 | .0502 | .0342 | .786 | .328 | .0615 | .0490 | .672 |
| .158 | .0409 | .0258 | .842 | .216 | .0505 | .0345 | .784 | .332 | .0618 | .0495 | .668 |
| .159 | .0411 | .0259 | .841 | .218 | .0508 | .0347 | .782 | .336 | .0620 | .0499 | .664 |
| .160 | .0413 | .0261 | .840 | .220 | .0510 | .0350 | .780 | .340 | .0622 | .0503 | .660 |
| .161 | .0415 | .0262 | .839 | .222 | .0513 | .0353 | .778 | .344 | .0624 | .0508 | .656 |
| .162 | .0417 | .0264 | .838 | .224 | .0516 | .0356 | .776 | .348 | .0626 | .0512 | .652 |
| .163 | .0419 | .0265 | .837 | .226 | .0519 | .0359 | .774 | .352 | .0627 | .0516 | .648 |
| .164 | .0420 | .0267 | .836 | .228 | .0521 | .0362 | .772 | .356 | .0629 | .0520 | .644 |
| .165 | .0422 | .0268 | .835 | .230 | .0524 | .0364 | .770 | .360 | .0631 | .0524 | .640 |
| .166 | .0424 | .0270 | .834 | .232 | .0526 | .0367 | .768 | .364 | .0632 | .0528 | .636 |
| .167 | .0426 | .0271 | .833 | .234 | .0529 | .0370 | .766 | .368 | .0633 | .0532 | .632 |
| .168 | .0428 | .0273 | .832 | .236 | .0531 | .0373 | .764 | .372 | .0634 | .0536 | .628 |
| .169 | .0429 | .0274 | .831 | .238 | .0534 | .0376 | .762 | .376 | .0636 | .0540 | .624 |
| .170 | .0431 | .0276 | .830 | .240 | .0536 | .0378 | .760 | .380 | .0637 | .0544 | .620 |
| .171 | .0433 | .0277 | .829 | .242 | .0539 | .0381 | .758 | .384 | .0638 | .0547 | .616 |
| .172 | .0435 | .0279 | .828 | .244 | .0541 | .0384 | .756 | .388 | .0638 | .0551 | .612 |
| .173 | .0437 | .0280 | .827 | .246 | .0543 | .0387 | .754 | .392 | .0639 | .0555 | .608 |
| .174 | .0438 | .0282 | .826 | .248 | .0546 | .0389 | .752 | .396 | .0640 | .0558 | .604 |
| .175 | .0440 | .0283 | .825 | .250 | .0548 | .0392 | .750 | .400 | .0640 | .0562 | .600 |
| .176 | .0442 | .0285 | .824 | .252 | .0550 | .0395 | .748 | .404 | .0641 | .0565 | .596 |
| .177 | .0443 | .0287 | .823 | .254 | .0553 | .0397 | .746 | .408 | .0641 | .0568 | .592 |
| .178 | .0445 | .0288 | .822 | .256 | .0555 | .0400 | .744 | .412 | .0641 | .0572 | .588 |
| .179 | .0447 | .0290 | .821 | .258 | .0557 | .0403 | .742 | .416 | .0641 | .0575 | .584 |
| .180 | .0449 | .0291 | .820 | .260 | .0559 | .0405 | .740 | .420 | .0641 | .0578 | .580 |
| .181 | .0450 | .0293 | .819 | .262 | .0561 | .0408 | .738 | .424 | .0641 | .0581 | .576 |
| .182 | .0452 | .0294 | .818 | .264 | .0563 | .0411 | .736 | .428 | .0641 | .0584 | .572 |
| .183 | .0454 | .0296 | .817 | .266 | .0565 | .0413 | .734 | .432 | .0641 | .0587 | .568 |
| .184 | .0455 | .0297 | .816 | .268 | .0567 | .0416 | .732 | .436 | .0641 | .0590 | .564 |
| .185 | .0457 | .0299 | .815 | .270 | .0569 | .0418 | .730 | .440 | .0640 | .0593 | .560 |
| .186 | .0459 | .0300 | .814 | .272 | .0571 | .0421 | .728 | .444 | .0640 | .0595 | .556 |
| .187 | .0460 | .0302 | .813 | .274 | .0573 | .0424 | .726 | .448 | .0639 | .0598 | .552 |
| .188 | .0462 | .0303 | .812 | .276 | .0575 | .0426 | .724 | .452 | .0639 | .0601 | .548 |
| .189 | .0463 | .0304 | .811 | .278 | .0577 | .0429 | .722 | .456 | .0638 | .0603 | .544 |
| .190 | .0465 | .0306 | .810 | .280 | .0579 | .0431 | .720 | .460 | .0637 | .0606 | .540 |
| .191 | .0467 | .0307 | .809 | .282 | .0581 | .0434 | .718 | .464 | .0636 | .0608 | .536 |
| .192 | .0468 | .0309 | .808 | .284 | .0582 | .0436 | .716 | .468 | .0635 | .0610 | .532 |
| .193 | .0470 | .0310 | .807 | .286 | .0584 | .0439 | .714 | .472 | .0634 | .0613 | .528 |
| .194 | .0471 | .0312 | .806 | .288 | .0586 | .0441 | .712 | .476 | .0633 | .0615 | .524 |
| .195 | .0473 | .0313 | .805 | .290 | .0588 | .0444 | .710 | .480 | .0632 | .0617 | .520 |
| .196 | .0475 | .0315 | .804 | .292 | .0589 | .0446 | .708 | .484 | .0630 | .0619 | .516 |
| .197 | .0476 | .0316 | .803 | .294 | .0591 | .0449 | .706 | .488 | .0629 | .0621 | .512 |
| .198 | .0478 | .0318 | .802 | .296 | .0593 | .0451 | .704 | .492 | .0627 | .0622 | .508 |
| .199 | 0.0479 | 0.0319 | .801 | .298 | 0.0594 | 0.0454 | .702 | .496 | 0.0626 | 0.0624 | .504 |
| 0.200 | | | 0.800 | 0.300 | | | 0.700 | 0.500 | | | 0.500 |
| | $E_1''$ | $E_0''$ | *n* | | $E_1''$ | $E_0''$ | *n* | | $E_1''$ | $E_0''$ | *n* |

*N. B.* -- The table is to be used like a critical table without interpolation

**TABLE - IX**

**JULIAN DAY NUMBER**

DAYS ELAPSED AT GREENWICH NOON OF JANUARY 0

| Yr. A.D. | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | 1000 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 175 7582 | 179 4107 | 183 0632 | 186 7157 | 190 3682 | 194 0207 | 197 6732 | 201 3257 | 204 9782 | 208 6307 |
| 20 | 176 4887 | 180 1412 | 183 7937 | 187 4462 | 191 0987 | 194 7512 | 198 4037 | 202 0562 | 205 7087 | 209 3612 |
| 40 | 177 2192 | 180 8717 | 184 5242 | 188 1767 | 191 8292 | 195 4817 | 199 1342 | 202 7867 | 206 4392 | 210 0917 |
| 60 | 177 9497 | 181 6022 | 185 2547 | 188 9072 | 192 5597 | 196 2122 | 199 8647 | 203 5172 | 207 1697 | 210 8222 |
| 80 | 178 6802 | 182 3327 | 185 9852 | 189 6377 | 193 2902 | 196 9427 | 200 5952 | 204 2477 | 207 9002 | 211 5527 |
| **Yr. A.D.** | **1100** | **1200** | **1300** | **1400** | **1500** | **1600** | **1700** | **1800** | **1900** | **2000** |
| | | | | | | | * | * | * | |
| 0 | 212 2832 | 215 9357 | 219 5882 | 223 2407 | 226 8932 | 230 5447 | 234 1971 | 237 8495 | 241 5020 | 245 1544 |
| 20 | 213 0137 | 216 6662 | 220 3187 | 223 9712 | 227 6237 | 231 2752 | 234 9276 | 238 5806 | 242 2324 | 245 8849 |
| 40 | 213 7442 | 217 3967 | 221 0492 | 224 7017 | 228 3542 | 232 0057 | 235 6581 | 239 3105 | 242 9629 | 246 6154 |
| 60 | 214 4747 | 218 1272 | 221 7797 | 225 4322 | 229 0847 | 232 7362 | 236 3886 | 240 0410 | 243 6934 | 247 3459 |
| 80 | 215 2052 | 218 8577 | 222 5102 | 226 1627 | 229 8152 | 233 4667 | 237 1191 | 240 7715 | 244 4239 | 248 0764 |
| | | | | | À | | | | | |
| 100 | 215 9357 | 219 5882 | 223 2407 | 226 8932 | 230 5447 | 234 1971 | 237 8495 | 241 5020 | 245 1544 | 248 8069 |

NUMBER OF DAYS TO BE ADDED TO REDUCE TO THE BEGINNING OF EACH MONTH

| Year | Jan. 0 | Feb. 0 | Mar. 0 | Apr. 0 | May 0 | Jun. 0 | July 0 | Aug. 0 | Sept. 0 | Oct. 0 | Nov. 0 | Dec. 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | * | * | | | | | | | | | | |
| 0 | 0 | 31 | 60 | 91 | 121 | 152 | 182 | 213 | 244 | 274 | 305 | 335 |
| 1 | 366 | 397 | 425 | 456 | 486 | 517 | 547 | 578 | 609 | 639 | 670 | 700 |
| 2 | 731 | 762 | 790 | 821 | 851 | 882 | 912 | 943 | 974 | 1004 | 1035 | 1065 |
| 3 | 1096 | 1127 | 1155 | 1186 | 1216 | 1247 | 1277 | 1308 | 1339 | 1369 | 1400 | 1430 |
| 4 | 1461 | 1492 | 1521 | 1552 | 1582 | 1613 | 1643 | 1674 | 1705 | 1735 | 1766 | 1796 |
| 5 | 1827 | 1858 | 1886 | 1917 | 1947 | 1978 | 2008 | 2039 | 2070 | 2100 | 2131 | 2161 |
| 6 | 2192 | 2223 | 2251 | 2282 | 2312 | 2343 | 2373 | 2404 | 2435 | 2465 | 2496 | 2526 |
| 7 | 2557 | 2588 | 2616 | 2647 | 2677 | 2708 | 2738 | 2769 | 2800 | 2830 | 2861 | 2891 |
| 8 | 2922 | 2953 | 2982 | 3013 | 3043 | 3074 | 3104 | 3135 | 3166 | 3196 | 3227 | 3257 |
| 9 | 3288 | 3319 | 3347 | 3378 | 3408 | 3439 | 3469 | 3500 | 3531 | 3561 | 3592 | 3622 |
| 10 | 3353 | 3684 | 3712 | 3743 | 3773 | 3804 | 3834 | 3865 | 3896 | 3926 | 3957 | 3987 |
| 11 | 4018 | 4049 | 4077 | 4108 | 4138 | 4169 | 4199 | 4230 | 4261 | 4291 | 4322 | 4352 |
| 12 | 4383 | 4414 | 4443 | 4474 | 4504 | 4535 | 4565 | 4596 | 4627 | 4657 | 4688 | 4718 |
| 13 | 4749 | 4780 | 4808 | 4839 | 4869 | 4900 | 4930 | 4961 | 4992 | 5022 | 5053 | 5083 |
| 14 | 5114 | 5145 | 5173 | 5204 | 5234 | 5265 | 5295 | 5326 | 5357 | 5387 | 5418 | 5448 |
| 15 | 5479 | 5510 | 5538 | 5569 | 5599 | 5630 | 5660 | 5691 | 5722 | 5752 | 5783 | 5813 |
| 16 | 5844 | 5875 | 5904 | 5935 | 5965 | 5996 | 6026 | 6057 | 6088 | 6118 | 6149 | 6179 |
| 17 | 6210 | 6241 | 6269 | 6300 | 6330 | 6361 | 6391 | 6422 | 6453 | 6483 | 6514 | 6544 |
| 18 | 6575 | 6606 | 6634 | 6665 | 6695 | 6726 | 6756 | 6787 | 6818 | 6848 | 6879 | 6909 |
| 19 | 6940 | 6971 | 6999 | 7030 | 7060 | 7091 | 7121 | 7152 | 7183 | 7213 | 7244 | 7274 |

À From 1582 October 15 to 1599 December 31 inclusive, Gregorian calendar, the numbers given by the above tables must be diminished by 10.

* The numbers given for the years 1700, 1800 and 1900 which are not leap years, are for January - 1 and consequently the numbers 0 and 31 for January 0 and February 0 of these years must be increased by 1 and read as 1 and 32 respectively.

*N.B.* To find the Julian Day Number for a B.C. date, first express the year astronomically, i.e. diminish it by 1 and put a negative sign before it. Then make the number positive by adding the smallest multiple of 1000. The Julian Day Number for the date thus obtained diminished by 365250 for each multiple of 1000 added will give the required Julian Day Number for the B.C. date in question.

The Julian Day is completed at noon. In order to obtain the Julian Day Number for $0^h$ U.T., diminish the figure obtained from the above tables by 0.5.

The tables give the Day Numbers upto 1582, Oct. 4 for the Julian calendar and from 1582, Oct. 15 onward for the Gregorian calendar.

## TABLE – X
## ATMOSPHERIC REFRACTION

MEAN REFRACTION FOR TEMPERATURE 25° C AND PRESSURE 1000 mb

| Apparent Altitude | Mean Refraction | Apparent Altitude | Mean Refraction | Apparent Altitude | Mean Refraction | Apparent Altitude | Mean Refraction |
|---|---|---|---|---|---|---|---|
| ° ′ | ′ ″ | ° ′ | ′ ″ | ° ′ | ′ ″ | ° | ′ ″ |
| -1 00 | 46 17.5 | 6 10 | 7 39.0 | 17 30 | 2 49.6 | 53 | 0 40.8 |
| 0 00 | 30 59.6 | 20 | 7 28.5 | 18 00 | 2 44.7 | 54 | 39.3 |
| +0 10 | 29 09.3 | 30 | 7 18.5 | 18 30 | 2 40.0 | 55 | 37.9 |
| 20 | 27 28.9 | 40 | 7 08.9 | 19 00 | 2 35.6 | 56 | 36.5 |
| 30 | 25 57.8 | 6 50 | 6 59.7 | 19 30 | 2 31.4 | 57 | 35.1 |
| 0 40 | 24 34.6 | 7 00 | 6 50.8 | 20 00 | 2 27.3 | 58 | 33.8 |
| 0 50 | 23 18.3 | 7 10 | 6 42.3 | 21 00 | 2 19.8 | 59 | 0 32.6 |
| 1 00 | 22 07.9 | 20 | 6 34.1 | 22 00 | 2 12.9 | 60 | 31.2 |
| 10 | 21 02.6 | 30 | 6 26.3 | 23 00 | 2 06.6 | 61 | 30.0 |
| 20 | 20 02.4 | 40 | 6 18.7 | 24 00 | 2 00.8 | 62 | 28.8 |
| 30 | 19 07.0 | 7 50 | 6 11.4 | 25 00 | 1 55.4 | 63 | 27.6 |
| 1 40 | 18 15.6 | 8 00 | 6 04.4 | 26 00 | 1 50.4 | 64 | 26.4 |
| 1 50 | 17 28.2 | 8 10 | 5 57.6 | 27 00 | 1 45.7 | 65 | 0 25.2 |
| 2 00 | 16 44.0 | 20 | 5 51.2 | 28 00 | 1 41.3 | 66 | 24.1 |
| 10 | 16 02.6 | 30 | 5 44.7 | 29 00 | 1 37.2 | 67 | 23.0 |
| 20 | 15 24.0 | 40 | 5 38.6 | 30 00 | 1 33.4 | 68 | 21.9 |
| 30 | 14 48.0 | 8 50 | 5 32.6 | 31 00 | 1 29.8 | 69 | 20.8 |
| 2 40 | 14 14.4 | 9 00 | 5 26.8 | 32 00 | 1 26.3 | 70 | 19.7 |
| 2 50 | 13 42.9 | 9 10 | 5 21.3 | 33 00 | 1 23.1 | 71 | 0 18.6 |
| 3 00 | 13 13.5 | 20 | 5 15.9 | 34 00 | 1 20.0 | 72 | 17.6 |
| 10 | 12 45.8 | 30 | 5 10.6 | 35 00 | 1 17.1 | 73 | 16.5 |
| 20 | 12 19.6 | 40 | 5 05.5 | 36 00 | 1 14.3 | 74 | 15.5 |
| 30 | 11 55.0 | 9 50 | 5 00.6 | 37 00 | 1 11.7 | 75 | 14.5 |
| 3 40 | 11 31.9 | 10 00 | 4 55.9 | 38 00 | 1 09.1 | 76 | 13.5 |
| 3 50 | 11 10.0 | 10 30 | 4 42.4 | 39 00 | 1 06.8 | 77 | 0 12.5 |
| 4 00 | 10 49.5 | 11 00 | 4 30.0 | 40 00 | 1 04.4 | 78 | 11.5 |
| 10 | 10 30.1 | 11 30 | 4 18.7 | 41 00 | 1 02.2 | 79 | 10.5 |
| 20 | 10 11.7 | 12 00 | 4 08.1 | 42 00 | 1 00.0 | 80 | 09.5 |
| 30 | 9 54.2 | 12 30 | 3 58.4 | 43 00 | 0 57.9 | 81 | 08.6 |
| 4 40 | 9 37.5 | 13 00 | 3 49.3 | 44 00 | 0 56.0 | 82 | 07.6 |
| 4 50 | 9 21.6 | 13 30 | 3 40.8 | 45 00 | 0 54.1 | 83 | 0 06.6 |
| 5 00 | 9 06.5 | 14 00 | 3 32.9 | 46 00 | 0 52.2 | 84 | 05.7 |
| 10 | 8 52.1 | 14 30 | 3 25.6 | 47 00 | 0 50.4 | 85 | 04.7 |
| 20 | 8 38.6 | 15 00 | 3 18.6 | 48 00 | 0 48.7 | 86 | 03.8 |
| 30 | 8 25.5 | 15 30 | 3 12.1 | 49 00 | 0 47.0 | 87 | 02.8 |
| 5 40 | 8 13.0 | 16 00 | 3 06.0 | 50 00 | 0 45.4 | 88 | 01.9 |
| 5 50 | 8 01.2 | 16 30 | 3 00.2 | 51 00 | 0 43.8 | 89 | 0 00.9 |
| 6 00 | 7 49.8 | 17 00 | 2 54.8 | 52 00 | 0 42.2 | 90 | 0 00.0 |
| 6 10 | 7 39.0 | 17 30 | 2 49.6 | 53 00 | 0 40.8 | | |

Rule: True altitude of a celestial object = Its apparent or observed altitude - refraction.

*N.B.*-The figures of mean refraction given in the above table are for temperature 25° C and pressure 1000 mb. (750.06 mm. Or 29.530 inches of mercury barometer). For other values of temperature and pressure, corrections form the tables on the following two pages are to be taken and applied to the mean refraction.

## TABLE - Xa
## ATMOSPHERIC REFRACTION
CORRECTION OF MEAN REFRACTION FOR DIFFERENT VALUES OF TEMPERATURE

| Apparent Altitude | - 10° C (14° F) | 0° C (32° F) | 10° C (50° F) | 20° C (68° F) | 25° C (77° F) | 30° C (86° F) | 40° C (104° F) | 50° C (122° F) |
|---|---|---|---|---|---|---|---|---|
| ° ′ | ′ ″ | ′ ″ | ′ ″ | ′ ″ | ′ ″ | ′ ″ | ′ ″ | ′ ″ |
| - 1 00 | + 13 31.7 | + 9 17.8 | + 5 13.4 | + 1 37.7 | 0 00.0 | - 1 32.6 | - 4 22.5 | - 6 54.8 |
| 0 00 | 7 16.3 | 5 04.8 | 2 53.4 | 0 54.8 | 0 00.0 | 0 52.1 | 2 29.6 | 3 58.2 |
| + 0 30 | 5 39.4 | 3 57.4 | 2 15.6 | 0 42.8 | 0 00.0 | 0 41.2 | 1 58.4 | 3 09.1 |
| 1 00 | 4 27.7 | 3 07.8 | 1 47.8 | 0 34.7 | 0 00.0 | 0 32.1 | 1 33.8 | 2 30.7 |
| 1 30 | 3 38.4 | 2 33.1 | 1 27.9 | 0 27.8 | 0 00.0 | 0 27.1 | 1 18.1 | 2 05.2 |
| 2 00 | 3 00.9 | 2 07.0 | 1 13.1 | 0 23.4 | 0 00.0 | 0 22.4 | 1 05.0 | 1 44.5 |
| 2 30 | + 2 32.9 | + 1 48.1 | + 1 02.1 | + 0 19.6 | 0 00.0 | - 0 19.5 | - 0 56.0 | - 1 29.9 |
| 3 00 | 2 12.7 | 1 33.2 | 0 53.8 | 0 17.2 | 0 00.0 | 0 16.7 | 0 48.2 | 1 17.5 |
| 3 30 | 1 56.6 | 1 21.9 | 0 47.3 | 0 15.1 | 0 00.0 | 0 14.6 | 0 42.4 | 1 08.3 |
| 4 00 | 1 43.2 | 1 12.5 | 0 42.0 | 0 13.5 | 0 00.0 | 0 12.9 | 0 37.6 | 1 00.6 |
| 4 30 | 1 32.5 | 1 05.0 | 0 37.9 | 0 12.0 | 0 00.0 | 0 11.7 | 0 33.9 | 0 54.5 |
| 5 00 | 1 23.7 | 0 58.9 | 0 35.0 | 0 10.9 | 0 00.0 | 0 10.6 | 0 30.7 | 0 49.5 |
| 6 00 | + 1 10.2 | + 0 49.4 | + 0 30.0 | + 0 09.1 | 0 00.0 | - 0 09.0 | - 0 25.8 | - 0 41.5 |
| 7 00 | 1 00.3 | 0 42.5 | 0 25.6 | 0 07.9 | 0 00.0 | 0 07.6 | 0 22.1 | 0 35.7 |
| 8 00 | 0 52.7 | 0 37.1 | 0 21.4 | 0 06.9 | 0 00.0 | 0 06.6 | 0 19.4 | 0 31.3 |
| 9 00 | 0 46.8 | 0 32.9 | 0 19.1 | 0 06.1 | 0 00.0 | 0 05.9 | 0 17.2 | 0 27.8 |
| 10 00 | 0 43.0 | 0 29.6 | 0 17.1 | 0 05.4 | 0 00.0 | 0 05.3 | 0 15.5 | 0 25.0 |
| 11 00 | 0 39.4 | 0 26.9 | 0 15.6 | 0 05.0 | 0 00.0 | 0 04.8 | 0 14.1 | 0 22.8 |
| 12 00 | + 0 35.7 | + 0 24.3 | + 0 14.2 | + 0 04.6 | 0 00.0 | - 0 04.4 | - 0 12.8 | - 0 20.7 |
| 13 00 | 0 33.1 | 0 22.6 | 0 13.2 | 0 04.2 | 0 00.0 | 0 04.0 | 0 11.9 | 0 19.2 |
| 14 00 | 0 30.4 | 0 21.0 | 0 12.1 | 0 03.9 | 0 00.0 | 0 03.7 | 0 11.0 | 0 17.7 |
| 15 00 | 0 28.4 | 0 19.6 | 0 11.3 | 0 03.6 | 0 00.0 | 0 03.5 | 0 10.2 | 0 16.5 |
| 16 00 | 0 26.4 | 0 18.2 | 0 10.3 | 0 03.4 | 0 00.0 | 0 03.3 | 0 09.5 | 0 15.4 |
| 17 00 | 0 24.8 | 0 17.2 | 0 09.9 | 0 03.2 | 0 00.0 | 0 03.1 | 0 08.9 | 0 14.4 |
| 18 00 | + 0 23.3 | + 0 16.2 | + 0 09.3 | + 0 03.0 | 0 00.0 | - 0 02.9 | - 0 08.4 | - 0 13.5 |
| 19 00 | 0 22.1 | 0 15.2 | 0 08.8 | 0 02.7 | 0 00.0 | 0 02.7 | 0 07.9 | 0 12.8 |
| 20 00 | 0 20.9 | 0 14.3 | 0 08.3 | 0 02.5 | 0 00.0 | 0 02.6 | 0 07.5 | 0 12.1 |
| 25 00 | 0 16.3 | 0 11.2 | 0 06.5 | 0 02.1 | 0 00.0 | 0 02.0 | 0 05.9 | 0 09.4 |
| 30 00 | 0 13.1 | 0 09.0 | 0 05.2 | 0 01.7 | 0 00.0 | 0 01.6 | 0 04.7 | 0 07.6 |
| 35 00 | 0 10.8 | 0 07.4 | 0 04.3 | 0 01.4 | 0 00.0 | 0 01.3 | 0 03.9 | 0 06.3 |
| 40 00 | + 0 09.0 | + 0 06.2 | + 0 03.6 | + 0 01.2 | 0 00.0 | - 0 01.1 | - 0 03.2 | - 0 05.2 |
| 45 00 | 0 07.5 | 0 05.2 | 0 03.0 | 0 01.0 | 0 00.0 | 0 00.9 | 0 02.7 | 0 04.4 |
| 50 00 | 0 06.0 | 0 04.4 | 0 02.5 | 0 00.8 | 0 00.0 | 0 00.8 | 0 02.3 | 0 03.7 |
| 55 00 | 0 05.3 | 0 03.6 | 0 02.1 | 0 00.7 | 0 00.0 | 0 00.7 | 0 02.0 | 0 03.1 |
| 60 00 | 0 04.4 | 0 03.0 | 0 01.8 | 0 00.6 | 0 00.0 | 0 00.6 | 0 01.6 | 0 02.5 |
| 65 00 | 0 03.6 | 0 02.4 | 0 01.4 | 0 00.5 | 0 00.0 | 0 00.5 | 0 01.3 | 0 02.1 |
| 70 00 | + 0 02.8 | + 0 01.9 | + 0 01.1 | + 0 00.4 | 0 00.0 | - 0 00.4 | - 0 01.0 | - 0 01.6 |
| 75 00 | 0 02.0 | 0 01.4 | 0 00.8 | 0 00.3 | 0 00.0 | 0 00.3 | 0 00.7 | 0 01.2 |
| 80 00 | 0 01.4 | 0 00.9 | 0 00.5 | 0 00.2 | 0 00.0 | 0 00.2 | 0 00.4 | 0 00.8 |
| 85 00 | 0 00.7 | 0 00.4 | 0 00.2 | 0 00.1 | 0 00.0 | 0 00.1 | 0 00.2 | 0 00.4 |
| 90 00 | + 0 00.0 | + 0 00.0 | + 0 00.0 | + 0 00.0 | 0 00.0 | - 0 00.0 | - 0 00.0 | - 0 00.0 |

**TABLE - Xb**
**ATMOSPHERIC REFRACTION**
PRESSURE CORRECTION OF REFRACTION FOR DIFFERENT VALUES OF PRESSURE

| PRESSURE | | | AMOUNT OF REFRACTION CORRECTED FOR PRESSURE | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1′ | 2′ | 3′ | 5′ | 10′ | 20′ | 30′ | 60′ |
| mb | mm | Inch | ″ | ″ | ″ | ′ ″ | ′ ″ | ′ ″ | ′ ″ | ′ ″ |
| 660 | 495.0 | 19.49 | - 20.4 | - 40.8 | - 61.3 | - 1 42.3 | - 3 26.5 | - 7 04.9 | - 10 59.1 | - 24 19 |
| 670 | 502.5 | 19.79 | 19.8 | 39.7 | 59.5 | 1 39.3 | 3 20.4 | 6 52.5 | 10 39.8 | 23 36 |
| 680 | 510.0 | 20.08 | 19.2 | 38.4 | 57.7 | 1 36.3 | 3 14.3 | 6 39.8 | 10 20.2 | 22 53 |
| 690 | 517.5 | 20.38 | 18.6 | 37.2 | 55.9 | 1 33.3 | 3 08.2 | 6 27.4 | 10 00.9 | 22 10 |
| 700 | 525.0 | 20.67 | 18.0 | 36.0 | 54.1 | 1 30.3 | 3 02.2 | 6 14.9 | 9 41.5 | 21 27 |
| 710 | 532.5 | 20.97 | 17.4 | 34.8 | 52.3 | 1 27.3 | 2 56.1 | 6 02.5 | 9 22.2 | 20 45 |
| 720 | 540.0 | 21.26 | - 16.8 | - 33.5 | - 50.6 | - 1 24.3 | - 2 50.0 | - 5 50.0 | - 9 02.8 | - 20 01 |
| 730 | 547.5 | 21.56 | 16.2 | 32.4 | 48.7 | 1 21.2 | 2 43.9 | 5 37.4 | 8 43.3 | 19 18 |
| 740 | 555.0 | 21.85 | 15.6 | 31.2 | 46.9 | 1 18.2 | 2 37.8 | 5 24.9 | 8 23.9 | 18 35 |
| 750 | 562.6 | 22.15 | 15.0 | 30.0 | 45.1 | 1 15.2 | 2 31.8 | 5 12.4 | 8 04.6 | 17 53 |
| 760 | 570.1 | 22.44 | 14.4 | 28.9 | 43.3 | 1 12.3 | 2 25.8 | 5 00.2 | 7 45.6 | 17 21 |
| 770 | 577.6 | 22.74 | 13.8 | 27.6 | 41.5 | 1 09.2 | 2 19.7 | 4 47.5 | 7 25.9 | 16 27 |
| 780 | 585.1 | 23.03 | - 13.2 | - 26.4 | - 39.7 | - 1 06.2 | - 2 13.6 | - 4 35.0 | - 7 06.5 | - 15 44 |
| 790 | 592.6 | 23.33 | 12.6 | 25.2 | 37.9 | 1 03.2 | 2 07.6 | 4 22.5 | 6 47.2 | 15 01 |
| 800 | 600.1 | 23.62 | 12.0 | 24.0 | 36.0 | 1 00.2 | 2 01.4 | 4 09.9 | 6 27.6 | 14 18 |
| 810 | 607.6 | 23.92 | 11.4 | 22.8 | 34.3 | 0 57.2 | 1 55.4 | 3 57.5 | 6 08.3 | 13 35 |
| 820 | 615.1 | 24.22 | 10.8 | 21.6 | 32.4 | 0 54.2 | 1 49.3 | 3 44.9 | 5 48.9 | 12 52 |
| 830 | 622.6 | 24.51 | 10.2 | 20.4 | 30.7 | 0 51.2 | 1 43.3 | 3 32.5 | 5 29.6 | 12 10 |
| 840 | 630.1 | 24.81 | - 9.6 | - 19.2 | - 28.9 | - 0 48.2 | - 1 37.2 | - 3 20.0 | - 5 10.2 | - 11 27 |
| 850 | 637.6 | 25.10 | 9.0 | 18.0 | 27.0 | 0 45.1 | 1 31.1 | 3 07.4 | 4 50.7 | 10 43 |
| 860 | 645.1 | 25.40 | 8.4 | 16.8 | 25.2 | 0 42.1 | 1 25.0 | 2 54.9 | 4 31.3 | 10 01 |
| 870 | 652.6 | 25.69 | 7.8 | 15.6 | 23.4 | 0 39.1 | 1 19.0 | 2 42.5 | 4 12.0 | 9 18 |
| 880 | 660.1 | 25.99 | 7.2 | 14.4 | 21.6 | 0 36.1 | 1 12.9 | 2 30.0 | 3 52.6 | 8 35 |
| 890 | 667.6 | 26.28 | 6.6 | 13.2 | 19.8 | 0 33.1 | 1 06.8 | 2 17.5 | 3 33.3 | 7 52 |
| 900 | 675.1 | 26.58 | - 6.0 | - 12.0 | - 18.0 | - 0 30.1 | - 1 00.7 | - 2 04.9 | - 3 13.7 | - 7 09 |
| 910 | 682.6 | 26.87 | 5.4 | 10.8 | 16.2 | 0 27.1 | 0 54.7 | 1 52.5 | 2 54.3 | 6 26 |
| 920 | 690.1 | 27.17 | 4.8 | 9.6 | 14.4 | 0 24.1 | 0 48.6 | 1 39.9 | 2 35.0 | 5 43 |
| 930 | 697.6 | 27.46 | 4.2 | 8.4 | 12.6 | 0 21.1 | 0 42.5 | 1 27.5 | 2 15.7 | 5 01 |
| 940 | 705.1 | 27.76 | 3.6 | 7.2 | 10.8 | 0 18.1 | 0 36.4 | 1 15.0 | 1 50.3 | 4 17 |
| 950 | 712.6 | 28.05 | 3.0 | 6.0 | 9.0 | 0 15.0 | 0 30.3 | 1 02.4 | 1 36.9 | 3 34 |
| 960 | 720.1 | 28.35 | - 2.4 | - 4.8 | - 7.2 | - 0 12.0 | - 0 24.3 | - 0 49.9 | - 1 17.4 | - 2 51 |
| 970 | 727.6 | 28.64 | 1.8 | 3.6 | 5.4 | 0 09.0 | 0 18.2 | 0 37.5 | 0 58.2 | 2 09 |
| 980 | 735.1 | 28.94 | 1.2 | 2.4 | 3.6 | 0 06.0 | 0 12.1 | 0 25.0 | 0 38.7 | 1 26 |
| 990 | 742.6 | 29.24 | - 0.6 | - 1.2 | - 1.8 | - 0 03.0 | - 0 06.1 | - 0 12.5 | - 0 19.4 | - 0 43 |
| 1000 | 750.1 | 29.53 | 0.0 | 0.0 | 0.0 | 0 00.0 | 0 00.0 | 0 00.0 | 0 00.0 | 0 00 |
| 1010 | 757.6 | 29.83 | + 0.6 | + 1.2 | + 1.8 | + 0 03.1 | + 0 06.1 | + 0 12.5 | + 0 19.5 | + 0 43 |
| 1020 | 765.1 | 30.12 | 1.2 | 2.4 | 3.6 | 0 06.0 | 0 12.2 | 0 25.1 | 0 38.9 | 1 26 |
| 1030 | 772.6 | 30.42 | 1.8 | 3.6 | 5.4 | 0 09.0 | 0 18.2 | 0 37.5 | 0 58.2 | 2 09 |
| 1040 | 780.1 | 30.71 | 2.4 | 4.8 | 7.2 | 0 12.0 | 0 24.3 | 0 50.0 | 0 77.6 | 2 52 |
| 1050 | 787.6 | 31.01 | + 3.0 | + 6.0 | + 9.0 | + 0 15.0 | + 0 30.3 | + 0 62.4 | + 0 96.9 | + 3 24 |

**TABLE - XI**
**FACTORS FOR COMPUTING THE GEOCENTRIC COORDINATES OF A PLACE**

| $\phi$ | *S* | *C* | $\phi$ | *S* | *C* |
|---|---|---|---|---|---|
| ° | | | ° | | |
| 0 | 0.993306 | 1.000000 | 45 | 0.994972 | 1.001678 |
| 1 | 0.993307 | 1.000001 | 46 | 0.995031 | 1.001737 |
| 2 | 0.993310 | 1.000004 | 47 | 0.995089 | 1.001795 |
| 3 | 0.993315 | 1.000009 | 48 | 0.995147 | 1.001854 |
| 4 | 0.993322 | 1.000016 | 49 | 0.995205 | 1.001912 |
| 5 | 0.993331 | 1.000025 | 50 | 0.995262 | 1.001970 |
| 6 | 0.993342 | 1.000037 | 51 | 0.995320 | 1.002028 |
| 7 | 0.993355 | 1.000050 | 52 | 0.995377 | 1.002085 |
| 8 | 0.993370 | 1.000065 | 53 | 0.995433 | 1.002142 |
| 9 | 0.993387 | 1.000082 | 54 | 0.995489 | 1.002198 |
| 10 | 0.993406 | 1.000101 | 55 | 0.995544 | 1.002254 |
| 11 | 0.993427 | 1.000122 | 56 | 0.995599 | 1.002309 |
| 12 | 0.993449 | 1.000145 | 57 | 0.995652 | 1.002363 |
| 13 | 0.993474 | 1.000169 | 58 | 0.995705 | 1.002416 |
| 14 | 0.993500 | 1.000196 | 59 | 0.995758 | 1.002468 |
| 15 | 0.993528 | 1.000224 | 60 | 0.995809 | 1.002520 |
| 16 | 0.993558 | 1.000254 | 61 | 0.995859 | 1.002570 |
| 17 | 0.993590 | 1.000286 | 62 | 0.995908 | 1.002620 |
| 18 | 0.993623 | 1.000320 | 63 | 0.995956 | 1.002668 |
| 19 | 0.993658 | 1.000355 | 64 | 0.996002 | 1.002715 |
| 20 | 0.993695 | 1.000392 | 65 | 0.996048 | 1.002761 |
| 21 | 0.993733 | 1.000430 | 66 | 0.996092 | 1.002805 |
| 22 | 0.993773 | 1.000470 | 67 | 0.996135 | 1.002848 |
| 23 | 0.993814 | 1.000511 | 68 | 0.996176 | 1.002890 |
| 24 | 0.993856 | 1.000554 | 69 | 0.996216 | 1.002930 |
| 25 | 0.993900 | 1.000598 | 70 | 0.996255 | 1.002969 |
| 26 | 0.993945 | 1.000644 | 71 | 0.996291 | 1.003006 |
| 27 | 0.993992 | 1.000691 | 72 | 0.996327 | 1.003041 |
| 28 | 0.994039 | 1.000739 | 73 | 0.996360 | 1.003075 |
| 29 | 0.994088 | 1.000788 | 74 | 0.996392 | 1.003107 |
| 30 | 0.994138 | 1.000838 | 75 | 0.996422 | 1.003138 |
| 31 | 0.994189 | 1.000889 | 76 | 0.996451 | 1.003166 |
| 32 | 0.994241 | 1.000941 | 77 | 0.996477 | 1.003193 |
| 33 | 0.994293 | 1.000994 | 78 | 0.996502 | 1.003218 |
| 34 | 0.994347 | 1.001048 | 79 | 0.996525 | 1.003241 |
| 35 | 0.994401 | 1.001103 | 80 | 0.996546 | 1.003262 |
| 36 | 0.994456 | 1.001158 | 81 | 0.996565 | 1.003281 |
| 37 | 0.994512 | 1.001214 | 82 | 0.996582 | 1.003299 |
| 38 | 0.994568 | 1.001271 | 83 | 0.996597 | 1.003314 |
| 39 | 0.994625 | 1.001328 | 84 | 0.996610 | 1.003327 |
| 40 | 0.994682 | 1.001386 | 85 | 0.996622 | 1.003338 |
| 41 | 0.994740 | 1.001444 | 86 | 0.996631 | 1.003348 |
| 42 | 0.994798 | 1.001502 | 87 | 0.996638 | 1.003355 |
| 43 | 0.994856 | 1.001560 | 88 | 0.996643 | 1.003360 |
| 44 | 0.994914 | 1.001619 | 89 | 0.996646 | 1.003363 |
| 45 | 0.994972 | 1.001678 | 90 | 0.996647 | 1.003364 |

$\rho \sin \phi' = (S+H) \sin \phi$ $\qquad$ $\rho \cos \phi' = (C+H) \cos \phi$

$H = 0.156779 \times$ elevation in meters $\times 10^{-6}$ $\qquad$ $H = 0.047786 \times$ elevation in feet $\times 10^{-6}$

**TABLE - XII**
**CONVERSION OF GEOGRAPHIC TO GEOCENTRIC COORDINATES**

| φ | φ′ - φ | ρ | ONE DEGREE OF Latitude | ONE DEGREE OF Longitude | φ | φ′ - φ | ρ | ONE DEGREE OF Latitude | ONE DEGREE OF Longitude |
|---|---|---|---|---|---|---|---|---|---|
| ° | ′ ″ | | Kilometers | Kilometers | ° | ′ ″ | | Kilometers | Kilometers |
| 0 | 0 00.0 | 1.000000 | 110.57 | 111.32 | 45 | - 11 32.7 | 0.998331 | 111.13 | 78.85 |
| 1 | - 0 24.1 | 0.999999 | 110.58 | 111.30 | 46 | 11 32.4 | 0.998272 | 111.15 | 77.46 |
| 2 | 0 48.2 | 0.999996 | 110.58 | 111.25 | 47 | 11 31.2 | 0.998214 | 111.17 | 76.06 |
| 3 | 1 12.2 | 0.999991 | 110.58 | 111.17 | 48 | 11 29.2 | 0.998155 | 111.19 | 74.63 |
| 4 | 1 36.1 | 0.999984 | 110.58 | 111.05 | 49 | 11 26.3 | 0.998097 | 111.21 | 73.17 |
| 5 | 1 59.9 | 0.999975 | 110.58 | 110.90 | 50 | 11 22.6 | 0.998039 | 111.23 | 71.70 |
| 6 | 2 23.6 | 0.999964 | 110.59 | 110.71 | 51 | 11 18.1 | 0.997982 | 111.25 | 70.20 |
| 7 | 2 47.0 | 0.999951 | 110.59 | 110.50 | 52 | 11 12.7 | 0.997925 | 111.27 | 68.68 |
| 8 | 3 10.3 | 0.999936 | 110.60 | 110.24 | 53 | 11 06.5 | 0.997868 | 111.29 | 67.14 |
| 9 | 3 33.4 | 0.999919 | 110.60 | 109.96 | 54 | 10 59.5 | 0.997812 | 111.31 | 65.58 |
| 10 | - 3 56.2 | 0.999900 | 110.61 | 109.64 | 55 | - 10 51.7 | 0.997756 | 111.32 | 63.99 |
| 11 | 4 18.7 | 0.999879 | 110.62 | 109.29 | 56 | 10 43.1 | 0.997702 | 111.34 | 62.39 |
| 12 | 4 40.9 | 0.999856 | 110.62 | 108.90 | 57 | 10 33.7 | 0.997648 | 111.36 | 60.77 |
| 13 | 5 02.8 | 0.999832 | 110.63 | 108.49 | 58 | 10 23.5 | 0.997594 | 111.38 | 59.13 |
| 14 | 5 24.3 | 0.999805 | 110.64 | 108.03 | 59 | 10 12.6 | 0.997542 | 111.40 | 57.48 |
| 15 | 5 45.4 | 0.999777 | 110.65 | 107.55 | 60 | 10 00.9 | 0.997491 | 111.41 | 55.80 |
| 16 | 6 06.0 | 0.999747 | 110.66 | 107.03 | 61 | 9 48.5 | 0.997440 | 111.43 | 54.11 |
| 17 | 6 26.3 | 0.999716 | 110.67 | 106.49 | 62 | 9 35.4 | 0.997391 | 111.45 | 52.40 |
| 18 | 6 46.1 | 0.999682 | 110.68 | 105.91 | 63 | 9 21.5 | 0.997343 | 111.46 | 50.67 |
| 19 | 7 05.4 | 0.999647 | 110.69 | 105.29 | 64 | 9 07.0 | 0.997296 | 111.48 | 48.93 |
| 20 | - 7 24.1 | 0.999611 | 110.70 | 104.65 | 65 | - 8 51.8 | 0.997250 | 111.49 | 47.18 |
| 21 | 7 42.4 | 0.999573 | 110.72 | 103.97 | 66 | 8 36.0 | 0.997206 | 111.51 | 45.40 |
| 22 | 8 00.0 | 0.999533 | 110.73 | 103.26 | 67 | 8 19.5 | 0.997163 | 111.52 | 43.62 |
| 23 | 8 17.1 | 0.999492 | 110.74 | 102.52 | 68 | 8 02.4 | 0.997121 | 111.54 | 41.82 |
| 24 | 8 33.6 | 0.999449 | 110.76 | 101.75 | 69 | 7 44.7 | 0.997081 | 111.55 | 40.01 |
| 25 | 8 49.5 | 0.999405 | 110.77 | 100.95 | 70 | 7 26.4 | 0.997042 | 111.56 | 38.19 |
| 26 | 9 04.7 | 0.999360 | 110.79 | 100.12 | 71 | 7 07.6 | 0.997005 | 111.57 | 36.35 |
| 27 | 9 19.3 | 0.999314 | 110.80 | 99.26 | 72 | 6 48.3 | 0.996970 | 111.59 | 34.50 |
| 28 | 9 33.2 | 0.999266 | 110.82 | 98.36 | 73 | 6 28.4 | 0.996936 | 111.60 | 32.65 |
| 29 | 9 46.4 | 0.999217 | 110.84 | 97.44 | 74 | 6 08.1 | 0.996904 | 111.61 | 30.78 |
| 30 | - 9 58.9 | 0.999167 | 110.85 | 96.49 | 75 | - 5 47.4 | 0.996874 | 111.61 | 28.90 |
| 31 | 10 10.7 | 0.999116 | 110.87 | 95.50 | 76 | 5 26.2 | 0.996845 | 111.62 | 27.02 |
| 32 | 10 21.7 | 0.999064 | 110.89 | 94.49 | 77 | 5 04.6 | 0.996818 | 111.63 | 25.12 |
| 33 | 10 32.0 | 0.999011 | 110.90 | 93.45 | 78 | 4 42.6 | 0.996793 | 111.64 | 23.22 |
| 34 | 10 41.5 | 0.998958 | 110.92 | 92.39 | 79 | 4 20.3 | 0.996770 | 111.65 | 21.31 |
| 35 | 10 50.2 | 0.998903 | 110.94 | 91.29 | 80 | 3 57.7 | 0.996749 | 111.66 | 19.39 |
| 36 | 10 58.1 | 0.998848 | 110.96 | 90 16 | 81 | 3 34.7 | 0.996730 | 111.67 | 17.47 |
| 37 | 11 05.3 | 0.998792 | 110.98 | 89.01 | 82 | 3 11.6 | 0.996713 | 111.67 | 15.54 |
| 38 | 11 11.6 | 0.998736 | 111.00 | 87.83 | 83 | 2 48.1 | 0.996697 | 111.68 | 13.61 |
| 39 | 11 17.1 | 0.998679 | 111.02 | 86.63 | 84 | 2 24.5 | 0.996684 | 111.68 | 11.67 |
| 40 | -11 21.8 | 0.998622 | 111.03 | 85.39 | 85 | - 2 00.7 | 0.996673 | 111.69 | 9.73 |
| 41 | 11 25.7 | 0.998564 | 111.05 | 84.14 | 86 | 1 36.7 | 0.996664 | 111.69 | 7.79 |
| 42 | 11 28.7 | 0.998506 | 111.07 | 82.85 | 87 | 1 12.7 | 0.996656 | 111.69 | 5.85 |
| 43 | 11 30.9 | 0.998447 | 111.09 | 81.54 | 88 | 0 48.5 | 0.996651 | 111.69 | 3.90 |
| 44 | 11 32.2 | 0.998389 | 111.11 | 80.21 | 89 | - 0 24.3 | 0.996648 | 111.69 | 1.95 |
| 45 | -11 32.7 | 0.998331 | 111.13 | 78.85 | 90 | 0 00.0 | 0.996647 | 111.69 | 0.00 |

φ and φ′ are the geographic and geocentric latitude respectively
ρ = radius of the earth.
1 kilometre = 0.621372 miles.

## LATITUDE AND LONGITUDE OF PLACES

| Place | Altitude (Metre) | Latitude | Longitude In arc | Longitude In time | Reduction of Greenwich Sid. Time | Reduction of L.M.T. to Indian Standard Time | ρ sin φ′ | ρ cos φ′ |
|---|---|---|---|---|---|---|---|---|
| | | ° ′ | ° ′ | h m s | s | m s | | |
| Agartala | 16 | +23 31.8 | + 91 09.0 | +6 04 36 | +59.89 | -34 36 | +0.39677 | 0.91734 |
| Agra | 160 | +27 05.6 | + 77 34.8 | +5 10 19 | +50.98 | +19 51 | +0.45272 | 0.89091 |
| Ahmedabad | 49 | +23 03.0 | + 72 40.2 | +4 50 41 | +47.75 | +39 19 | +0.38912 | 0.92064 |
| Aizawl | 1097 | +23 26.4 | + 92 43.2 | +6 10 53 | +60.93 | -40 53 | +0.39540 | 0.91812 |
| Ajmer | 486 | +26 16.2 | + 74 22.2 | +4 57 29 | +48.87 | +32 31 | +0.43996 | 0.89738 |
| Alibag (Obs.) Mumbai, | 7 | +19 00.0 | + 72 30.6 | +4 50 02 | +47.65 | +39 58 | +0.33350 | 0.94586 |
| Aligarh | 187 | +27 31.8 | + 78 2.44 | +5 12 10 | +51.28 | +17 47 | +0.45946 | 0.88743 |
| Allahabad | 96 | +25 16.2 | + 81 26.4 | +5 25 46 | +53.51 | +04 14 | +0.42429 | 0.90487 |
| Amritsar | 231 | +31 22.8 | + 74 31.2 | +4 58 05 | +48.97 | +31 55 | +0.51771 | 0.85454 |
| Bangalore | 921 | +12 34.8 | + 77 21.0 | +5 09 24 | +50.83 | +20 36 | +0.21641 | 0.97629 |
| Bangkok, Thailand | 16 | +13 25.0 | +100 18.0 | +6 41 12 | +65.91 | - 71 12 | +0.23052 | 0.97289 |
| Baroda | 35 | +22 12.0 | + 73 9.6 | +4 52 38 | +48.07 | +37 22 | +0.37549 | 0.92632 |
| Bhopal | 506 | +23 10.2 | + 77 12.6 | +5 08 50 | +50.73 | +21 10 | +0.39106 | 0.91989 |
| Bhuj | 105 | +23 09.0 | + 69 24.0 | +4 37 36 | +45.60 | +52 24 | +0.39072 | 0.91997 |
| Bhubaneswar | 46 | +20 00.0 | + 85 30.0 | +5 42 00 | +56.18 | - 12 00 | +0.33987 | 0.94007 |
| Bikaner | 224 | +28 01.0 | + 73 10.8 | +4 52 43 | +48.09 | +37 17 | +0.46695 | 0.88349 |
| Bilaspur,(H.P) | 502 | +31 11.4 | + 76 30.0 | +5 06 00 | +50.27 | +24 00 | +0.51491 | 0.85629 |
| Buenos Aires (Naval Obs.), Argentina | 6 | -34 21.0 | - 58 12.0 | - 3 52 48 | -38.24 | .. .. | -0.56107 | 0.82649 |
| Cairo | 68 | +30 01.0 | + 31 09.0 | +2 04 36 | +20.47 | .. .. | +0.49733 | 0.86662 |
| Canberra (Mount Stromlo), Australia | 767 | -35 10.2 | +149 10.5 | +9 56 42 | +98.02 | .. .. | -0.57285 | 0.81845 |
| Cape Town (Ast. Obs.), S. Africa | 18 | -33 33.6 | + 18 15.0 | +1 13 00 | +11.99 | .. .. | -0.54967 | 0.83416 |
| Chandigarh | 347 | +30 25.2 | + 76 32.0 | +5 06 08 | +50.29 | +23 52 | +0.50340 | 0.86312 |
| Chennai (or Madras) Obs. | 7 | +13 00.0 | + 80 06.6 | +5 20 26 | +52.64 | + 9 34 | +0.22348 | 0.97454 |
| Chittagong, Bangladesh | 27 | +22 12.6 | + 91 31.8 | +6 06 07 | +60.14 | - 36 07 | +0.37565 | 0.92625 |
| Colaba Obs. Mumbai, (Bombay) | 14 | +19 04.2 | + 72 31.0 | +4 50 04 | +47.65 | +39 56 | +0.32465 | 0.94546 |
| Colombo (Obs.), Srilanka | 6 | + 6 33.6 | + 79 33.6 | +5 18 14 | +52.28 | +11 46 | +011348 | 0.99350 |
| Cuttack | 26 | +20 16.8 | + 85 33.6 | +5 42 14 | +56.42 | - 12 14 | +0.34443 | 0.93839 |
| Dacca,Bangladesh | 7 | +23 25.8 | + 90 15.6 | +6 01 02 | +59.31 | - 31 02 | +0.39518 | 0.91803 |
| Darjeeling | 2128 | +27 02.0 | + 88 10.8 | +5 52 43 | +57.94 | - 22 43 | +0.45193 | 0.89166 |
| Dehra Dun | 682 | +30 11.3 | + 78 01.2 | +5 12 05 | +51.27 | +17 55 | +0.49995 | 0.86520 |
| Delhi | 220 | +28 21.0 | + 77 07.2 | +5 08 29 | +50.68 | +21 31 | +0.47205 | 0.88076 |
| Dibrugarh | 106 | +27 17.4 | + 94 06.0 | +6 16 24 | +61.83 | - 46 24 | +0.45575 | 0.88734 |
| Gangtok | 1768 | +27 12.0 | + 88 22.2 | +5 53 29 | +58.07 | - 23 29 | +0.45448 | 0.89029 |
| Guwahati | 55 | +26 3.6.0 | + 91 21.0 | +6 05 24 | +60.03 | - 35 24 | +0.43666 | 0.89892 |
| Gauribidanur (Radio Astr. Obs.) | 686 | +13 36.2 | + 77 26.1 | +5 09 44 | +50.88 | +20 16 | +0.23369 | 0.97223 |
| Gaya | 111 | +24 27.0 | + 84 34.2 | +5 38 17 | +55.57 | - 8 17 | +0.41137 | 0.91086 |

1 metre = 3.2808 feet

## LATITUDE AND LONGITUDE OF PLACES

| Place | Altitude (Metre) | Latitude | Longitude In arc | Longitude In time | Reduction of Greenwich Sid. Time | Reduction of L.M.T. to Indian Standard Time | ρ sin φ′ | ρ cos φ′ |
|---|---|---|---|---|---|---|---|---|
| | | ° ′ | ° ′ | h m s | s | m s | | |
| Geneva (Obs.), Switzerland | 465 | +46 07.8 | + 6 04.2 | +0 24 17 | + 3.99 | .. .. | +0.71739 | 0.69428 |
| Greenwich (Royal Obs.). | 47 | +51 28.6 | 0 00 | 0 00 00.0 | 0.00 | .. .. | +0.77872 | 0.62412 |
| Hanle/ Mt.Saraswati (Indian Ast. Obs.) | 4467 | +32 46.8 | + 78 57.9 | +5 15 51.6 | +51.89 | +14 8.4 | +0.53870 | 0.84217 |
| Haridwar | 274 | +29 34.8 | + 78 08.0 | +5 12 32.0 | +51.34 | + 17 28 | +0.49076 | 0.87041 |
| Heidelberg Obs., Germany | 570 | +49 14.0 | + 8 25.2 | +0 33 41.0 | + 5.53 | .. .. | +0.75382 | 0.65430 |
| Helwan (Obs.), Egypt | 116 | +29 51.5 | + 31 22.8 | +2 05 31.2 | +20.62 | .. .. | +0.49494 | 0.86800 |
| Herstmonceux (Royal Obs.), Sussex, U.K. | 31 | +50 52.0 | + 0 20.3 | +0 01 21.0 | + 0.22 | .. .. | +0.77205 | 0.63241 |
| Hyderabad (Nizamiah Obs.) | 554 | +17 25.9 | + 78 27.2 | +5 13 49.0 | +51.55 | + 16 11 | +0.29768 | 0.95444 |
| Imphal | 801 | +24 26.4 | + 93 34.8 | +6 14 19.0 | +61.49 | - 44 19 | +0.41126 | 0.91103 |
| India, Central Station of | - | +23 11.0 | + 82 30.0 | +5 30 00.0 | +54.21 | 0 00 | +0.39124 | 0.91973 |
| Indore | 556 | +22 26.4 | + 75 30.0 | +5 02 00.0 | +49.61 | + 28 00 | +0.37938 | 0.92481 |
| Istambul (Univ. Obs.), Turkey | 65 | +41 00.7 | + 28 57.9 | +1 55 51.6 | +19.03 | .. .. | +0.65277 | 0.75567 |
| IUCAA Giravali Obs., Pune | 1000 | +18 19.2 | + 73 30.6 | +4 54 02.0 | +48.3 | +35 58 | +0.31237 | 0.94978 |
| Jabalpur | 393 | +23 07.2 | + 79 34.2 | +5 18 17.0 | +52.29 | + 11 43 | +0.39026 | 0.92022 |
| Jaipur | 436 | +26 33.0 | + 75 31.2 | +5 02 05.0 | +49.62 | + 27 55 | +0.44431 | 0.89520 |
| Jakarta, Indonesia | 23 | - 6 07.2 | +106 30.0 | +7 06 00.0 | +69.98 | .. .. | -0.10590 | 0.99434 |
| Jamshedpur | 152 | +22 29.4 | + 86 06.6 | +5 44 26.0 | +56.58 | - 14 26 | +0.38016 | 0.92442 |
| Japal Rangapur (Obs.), | 695 | +17 05.9 | + 78 43.7 | +5 14 55.0 | +51.73 | + 15 05 | +0.29216 | 0.95618 |
| Jodhpur | 224 | +26 10.8 | + 73 00.6 | +4 52 02.0 | +47.97 | + 37 58 | +0.43854 | 0.89803 |
| Johannesberg, South Africa | 1806 | - 26 10.9 | + 28 04.5 | +1 52 18.0 | +18.45 | .. .. | -0.43868 | 0.89824 |
| Kabul, Afghanistan | 1766 | +34 18.0 | + 69 10.8 | +4 36 43.0 | +45.46 | + 53 17 | +0.56051 | 0.82721 |
| Kanchipuram | 76 | +12 30.0 | + 79 27.0 | +5 17 48.0 | +52.21 | + 12 12 | +0.21503 | 0.97646 |
| Kanpur | 126 | +26 15.6 | + 80 13.2 | +5 20 53.0 | +52.71 | + 9 07 | +0.43978 | 0.89740 |
| Karachi, Pakistan | 4 | +24 53.6 | + 67 02.4 | +4 28 10.0 | +44.05 | + 61 50 | +0.41836 | 0.90763 |
| Kathmandu, Nepal | 1324 | +27 23.2 | + 85 07.2 | +5 40 29.0 | +55.93 | - 10 29 | +0.45733 | 0.88874 |
| Kavalur (Vainu Bappu Obs.), | 725 | +12 34.6 | + 78 49.6 | +5 15 18.0 | +51.80 | + 14 42 | +0.21635 | 0.97627 |
| Kodaikanal (Solar Obs.) | 2343 | +10 13.8 | + 77 28.1 | +5 09 52.0 | +50.90 | + 20 08 | +0.17649 | 0.98457 |
| Kohima | 1405 | +25 24.0 | + 94 04.8 | +6 16 19.0 | +61.82 | - 46 19 | +0.42642 | 0.90409 |
| Kolkata (Alipore Obs.), (Calcutta) | 6 | +22 19.2 | + 88 12.0 | +5 52 48.0 | +57.96 | - 22 48 | +0.37742 | 0.92553 |
| Kolkata (Presi. Coll. Obs.) | 12 | +22 23.4 | + 88 16.2 | +5 53 05.0 | +58.00 | - 23 05 | +0.37854 | 0.92506 |
| Kurnool | 281 | +15 30.0 | + 78 03.0 | +5 12 12.0 | +51.29 | + 17 48 | +0.26552 | 0.96390 |

1 metre = 3.2808 feet

## LATITUDE AND LONGITUDE OF PLACES

| Place | Altitude (Metre) | Latitude | Longitude In arc | Longitude In time | Reduction of Greenwich Sid. Time | Reduction of L.M.T. to Indian Standard Time | ρ sin φ′ | ρ cos φ′ |
|---|---|---|---|---|---|---|---|---|
| | | ° ′ | ° ′ | h m s | s | m s | | |
| Kyoto (Univ. Ast. Dept. Obs.), Japan | 86 | +35 00.6 | +135 20.4 | +9 1 22.0 | +88.93 | .. .. | +0.57052 | 0.81997 |
| Lahore, Pakistan | 214 | +31 22.2 | + 74 15.6 | +4 57 02.0 | +48.80 | + 32 58 | +0.51756 | 0.85269 |
| Lucknow | 113 | +26 31.2 | + 80 33.6 | +5 22 14.0 | +52.94 | + 7 46 | +0.44383 | 0.89539 |
| Maitri (Indian base station at Antarctica) | 132 | -70 46.0 | + 11 45.0 | +0 47 00.0 | + 7.72 | .. .. | -0.94069 | 0.33041 |
| Mangalore | 22 | +12 33.0 | + 74 31.8 | +4 58 07.0 | +48.97 | + 31 53 | +0.21587 | 0.97626 |
| Moscow (Sternberg State Ast. Inst.), Russia | 195 | +55 27.0 | + 37 22.2 | +2 29 29.0 | +24.56 | .. .. | +0.82001 | 0.56843 |
| Mount Abu (Gurushikhar Obs.) | 1700 | +24 23.4 | + 72 25.8 | +4 49 43.0 | +47.59 | +40 17 | +0.41053 | 0.91152 |
| Mount Palomar (Obs.), U.S.A. | 1706 | +33 21.4 | -116 51.8 | - 7 47 27.2 | -76.79 | .. .. | +054687 | 0.83633 |
| Mount Wilson (Obs.), U.S.A. | 1742 | +34 13.0 | -118 03.6 | - 7 52 14.4 | -77.58 | .. .. | +0.55931 | 0.82802 |
| Mysore | 767 | +12 10.8 | + 76 25.2 | +5 05 41.0 | +50.22 | + 24 19 | +0.20963 | 0.97775 |
| Nagpur | 312 | +21 05.4 | + 79 04.2 | +5 16 17.0 | +51.96 | + 13 43 | +0.35760 | 0.93347 |
| Nainital (Aryabhatta Res. Inst. Of Obs. Sci.) | 1927 | +29 13.8 | + 79 18.0 | +5 17 12.0 | +52.11 | + 12 48 | +0. 48558 | 0.87363 |
| New York (Rutherford Obs.), U.S.A. | 25 | +40 25.8 | - 74 00.6 | - 4 56 02.0 | -48.63 | .. .. | +0.64509 | 0.76228 |
| Ottawa, Canada | 87 | +45 16.2 | - 75 22.2 | - 5 01 29.0 | -49.53 | .. .. | +0.70688 | 0.70497 |
| Panaji | 56 | +15 18.0 | + 73 33.0 | +4 54 12.0 | +48.33 | + 35 48 | +0.26217 | 0.96479 |
| Paris (Obs.), France | 67 | +48 30.0 | + 2 12.0 | +0 08 49.0 | + 1.45 | .. .. | +0.74535 | 0.66387 |
| Patiala | 251 | +30 12.0 | + 76 15.0 | +5 05 00.0 | +50.10 | + 25 00 | +0.50010 | 0.86504 |
| Patna | 53 | +25 21.6 | + 85 03.6 | +5 40 14.0 | +55.89 | - 10 14 | +0.42570 | 0.90420 |
| Peshawar, Pakistan | 358 | +34 01.0 | + 71 34.0 | +4 46 15.0 | +47.03 | + 43 45 | +0.55630 | 0.82979 |
| Pondicherry | 6 | +11 34.8 | + 79 29.4 | +5 17 58.0 | +52.23 | + 12 02 | +0. 19942 | 0.97978 |
| Pune | 559 | +18 19.0 | + 73 30.0 | +4 54 00.0 | +48 .30 | + 36 00 | +0.31230 | 0.94973 |
| Porbandar | 7 | +21 22.2 | + 69 29.4 | +4 37 58.0 | +45.66 | + 52 02 | +0.36211 | 0.93166 |
| Port Blair | 79 | +11 24.0 | + 92 25.8 | +6 09 43.0 | +60.74 | - 39 43 | +0.19636 | 0.98041 |
| Puri | 6 | +19 28.8 | + 85 29.4 | +5 41 58.0 | +56.18 | - 11 58 | +0.33137 | 0.94311 |
| Quetta, Pakistan | 1673 | +30 07.2 | + 67 00.0 | +4 28 00.0 | +44.03 | + 62 00 | +0.49901 | 0.86593 |
| Rajkot | 132 | +22 10.8 | + 70 33.6 | +4 42 14.0 | +46 .36 | + 47 46 | +0.37518 | 0.92646 |
| Rawalpindi, Pakistan | 510 | +33 22.2 | + 73 03.6 | +4 52 14.0 | +48.01 | + 37 46 | +0.54696 | 0.83605 |
| Rome (Obs.), Italy | 152 | +41 33.0 | + 12 16.8 | +0 49 07.2 | + 8.07 | .. .. | +0.65982 | 0.74950 |
| San Fernando (Naval Obs.), Spain | 27 | +36 28.0 | - 6 12.2 | -0 24 48.8 | - 4.08 | .. .. | +0.59108 | 0.80516 |
| Shillong | 1500 | +25 20.4 | + 91 33.6 | +6 06 14.0 | +61.16 | - 36 14 | +0.42549 | 0.90455 |

1 metre = 3.2808 feet

## LATITUDE AND LONGITUDE OF PLACES

| Place | Altitude (Metre) | Latitude | Longitude In arc | Longitude In time | Reduction of Greenwich Sid. Time | Reduction of L.M.T. to Indian Standard Time | ρ sin φ′ | ρ cos φ′ |
|---|---|---|---|---|---|---|---|---|
| | | ° ′ | ° ′ | h m s | s | m s | | |
| Sholapur | 476 | +17 24.0 | + 75 33.6 | +5 02 14 | +49.65 | + 27 46 | +0.29715 | 0.95460 |
| Siliguri | 127 | +26 24.0 | + 88 13.2 | +5 52 53 | +57.97 | - 22 53 | +0.44196 | 0.89632 |
| Simla | 2202 | +31 03.6 | + 77 07.8 | +5 08 31 | +50. 68 | + 21 29 | +0.51312 | 0.85769 |
| Singapore | 18 | + 1 10.2 | +103 30.6 | +6 54 02 | +68.02 | .. .. | +0.02028 | 0.99980 |
| Srinagar | 1586 | +34 03.6 | + 74 30.6 | +4 58 02 | +48.96 | + 31 58 | +0.55704 | 0.82953 |
| St. Petersburg Univ. Obs., Russia | 3 | +59 56.5 | + 30 17.7 | +2 01 11 | +19.91 | .. .. | +0.86189 | 0.50214 |
| Tehran, Iran | 1200 | +35 24.6 | + 51 15.0 | +3 25 00 | +33.68 | .. .. | +0.57630 | 0.81610 |
| Tokyo (Hydrographic Obs.), Japan | 41 | +35 24.0 | +138 27.0 | +9 13 48 | +90.98 | .. .. | +0.57605 | 0.81605 |
| Thiruvanantapuram | 61 | + 8 17.4 | + 76 34.2 | +5 06 17 | +50.31 | + 23 43 | +0.14323 | 0.98963 |
| Udaipur (Solar Obs.) | 301 | +24 21.0 | + 73 25.2 | +4 53 41 | +48.24 | + 36 19 | +0.40980 | 0.91161 |
| Udhagamandalam (Ooty) (Rad. Astr.Centre) | 2150 | +11 22.9 | + 76 40.0 | +5 06 40 | +50.38 | + 23 20 | +0.19611 | 0.98079 |
| Ujjain | 496 | +23 06.3 | + 75 28.2 | +5 01 53 | +49.59 | + 28 07 | +0.39002 | 0.92033 |
| Varanasi | 76 | +25 10.8 | + 83 00.0 | +5 32 00 | +54.54 | - 2 00 | +0.42288 | 0.90554 |
| Visakhapatnam | 38 | +17 25.8 | + 83 08.4 | +5 32 34 | +54.63 | - 2 34 | +0.29763 | 0.95438 |
| Washington (U. S. Naval Obs.), U.S.A. | 92 | +38 33.0 | - 77 02.4 | - 5 08 10 | -50.62 | .. .. | +0.61984 | 0.78309 |
| Yangon, Myanmar | 28 | +16 27.0 | + 96 7.20 | +6 24 29 | +63.16 | - 54 29 | +0.28136 | 0.95933 |

1 metre = 3.2808 feet

## SEMI-DIURNAL AND SEMI-NOCTURNAL ARCS
(FOR TRUE ALTITUDE = 0)

| Lat. / Decli. | 0° | 10° | 20° | 30° | 35° | 40° | 45° | 50° | 52° | 54° | 56° | 58° | 60° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ° ' | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m | h m |
| 0 00 | 6 00 | 6 00 | 6 00 | 6 00 | 6 00 | 6 00 | 6 00 | 6 00 | 6 00 | 6 00 | 6 00 | 6 00 | 6 00 |
| 5 00 | 6 00 | 6 04 | 6 07 | 6 12 | 6 14 | 6 17 | 6 20 | 6 24 | 6 26 | 6 28 | 6 30 | 6 32 | 6 35 |
| 10 00 | 6 00 | 6 07 | 6 15 | 6 23 | 6 28 | 6 34 | 6 41 | 6 49 | 6 52 | 6 56 | 7 01 | 7 06 | 7 11 |
| 15 00 | 6 00 | 6 11 | 6 22 | 6 36 | 6 43 | 6 52 | 7 02 | 7 14 | 7 20 | 7 27 | 7 34 | 7 42 | 7 51 |
| 20 00 | 6 00 | 6 15 | 6 30 | 6 49 | 6 59 | 7 11 | 7 25 | 7 43 | 7 51 | 8 00 | 8 11 | 8 22 | 8 36 |
| 23 00 | 6 00 | 6 18 | 6 36 | 6 58 | 7 11 | 7 25 | 7 43 | 8 05 | 8 15 | 8 27 | 8 40 | 8 56 | 9 15 |
| 25 00 | 6 00 | 6 19 | 6 39 | 7 02 | 7 16 | 7 32 | 7 51 | 8 15 | 8 27 | 8 40 | 8 55 | 9 13 | 9 35 |
| 28 00 | 6 00 | 6 22 | 6 45 | 7 12 | 7 27 | 7 46 | 8 08 | 8 37 | 8 52 | 9 08 | 9 28 | 9 59 | 10 28 |
| 30 00 | 6 00 | 6 23 | 6 49 | 7 18 | 7 35 | 7 56 | 8 21 | 8 54 | 9 11 | 9 30 | 9 55 | 10 30 | 12 00 |

When the latitude of the place and the declination of the heavenly body are of the same sign then the figure represent semi-diurnal arc, when of opposite signs then semi-nocturnal arc.

## AMPLITUDE OF RISING AND SETTING
(FOR TRUE ALTITUDE = 0)

| Lat. / Decli. | 0° | 10° | 20° | 30° | 35° | 40° | 45° | 50° | 52° | 54° | 56° | 58° | 60° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ° ' | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' |
| 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 | 0 00 |
| 5 00 | 5 00 | 5 05 | 5 19 | 5 47 | 6 06 | 6 32 | 7 05 | 7 48 | 8 08 | 8 32 | 8 58 | 9 28 | 10 02 |
| 10 00 | 10 00 | 10 09 | 10 39 | 11 34 | 12 14 | 13 06 | 14 13 | 15 40 | 16 23 | 17 11 | 18 05 | 19 08 | 20 19 |
| 15 00 | 15 00 | 15 14 | 15 59 | 17 23 | 18 25 | 19 45 | 21 28 | 23 45 | 24 52 | 26 07 | 27 34 | 29 14 | 31 10 |
| 20 00 | 20 00 | 20 19 | 21 21 | 23 16 | 24 41 | 26 31 | 28 56 | 32 09 | 33 45 | 35 35 | 37 42 | 40 12 | 43 10 |
| 23 00 | 23 00 | 23 50 | 25 03 | 27 21 | 29 04 | 31 18 | 34 15 | 38 15 | 40 16 | 42 37 | 45 22 | 48 40 | 52 44 |
| 25 00 | 25 00 | 25 25 | 26 44 | 29 13 | 31 04 | 33 29 | 36 42 | 41 06 | 43 21 | 45 58 | 49 06 | 52 54 | 57 42 |
| 28 00 | 28 00 | 28 28 | 29 58 | 32 50 | 34 58 | 37 48 | 41 36 | 46 55 | 49 41 | 53 00 | 57 06 | 62 22 | 69 52 |
| 30 00 | 30 00 | 30 31 | 32 09 | 35 16 | 37 37 | 40 45 | 45 00 | 51 04 | 54 18 | 58 17 | 63 24 | 70 39 | 90 00 |

The amplitude of rising and setting points of a heavenly body is measured from the East or the West point of the horizon towards the northern or southern direction as the case may be. The amplitude is of the same sign as that of declination of the body.

*Note* - If true zenith distance of the heavenly body at the time of rising or setting be 90° + *h*, then the figures of the above two tables would require some correction according to the value of *h* (vide Explanation).

## AUGMENTATION OF MOON'S SEMI-DIAMETER
Moon 's Apparent Altitude

| Semi-diameter | 0° | 6° | 12° | 18° | 24° | 30° | 36° | 42° | 48° | 54° | 60° | 66° | 72° | 78° | 84° | 90° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ′ ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ |
| 14 30 | 0.1 | 1.5 | 2.9 | 4.3 | 5.6 | 6.9 | 8.1 | 9.2 | 10.2 | 11.1 | 11.8 | 12.5 | 13.0 | 13.4 | 13.6 | 13.7 |
| 15 00 | 0.1 | 1.6 | 3.1 | 4.6 | 6.0 | 7.3 | 8.6 | 9.8 | 10.9 | 11.8 | 12.7 | 13.4 | 13.9 | 14.3 | 14.6 | 14.6 |
| 15 30 | 0.1 | 1.7 | 3.3 | 4.9 | 6.4 | 7.9 | 9.2 | 10.5 | 11.6 | 12.7 | 13.5 | 14.3 | 14.9 | 15.3 | 15.6 | 15.6 |
| 16 00 | 0.1 | 1.9 | 3.6 | 5.2 | 6.8 | 8.4 | 9.8 | 11.2 | 12.4 | 13.5 | 14.4 | 15.2 | 15.9 | 16.3 | 16.6 | 16.7 |
| 16 30 | 0.2 | 2.0 | 3.8 | 5.6 | 7.3 | 8.9 | 10.5 | 11.9 | 13.2 | 14.4 | 15.4 | 16.2 | 16.9 | 17.4 | 17.6 | 17.7 |
| 17 00 | 0.2 | 2.1 | 4.0 | 5.9 | 7.7 | 9.5 | 11.1 | 12.6 | 14.0 | 15.3 | 16.3 | 17.2 | 17.9 | 18.4 | 18.7 | 18.8 |

The visible or apparent semi-diameter of the moon is augmented over the tabulated value due to moon's altitude above the horizon.

## NATURAL TRIGONOMETRIC FUNCTIONS

| ANGLE | | Sin | Cos | Tan | Cot | Sec | Cosec | | |
|---|---|---|---|---|---|---|---|---|---|
| Arc | Time | | | | | | | | |
| ° | h m | | | | | | | h m | ° |
| 0 | 0 00 | 0.00000 | 1.00000 | 0.00000 | Infinity | 1.00000 | Infinity | 6 00 | 90 |
| 1 | 0 04 | .01745 | 0.99985 | .01746 | 57.28996 | .00015 | 57.29869 | 5 56 | 89 |
| 2 | 0 08 | .03490 | .99939 | .03492 | 28.63625 | .00061 | 28.65371 | 5 52 | 88 |
| 3 | 0 12 | .05234 | .99863 | .05241 | 19.08114 | .00137 | 19.10732 | 5 48 | 87 |
| 4 | 0 16 | .06976 | .99756 | .06993 | 14.30067 | .00244 | 14.33559 | 5 44 | 86 |
| 5 | 0 20 | .08716 | .99619 | .08749 | 11.43005 | .00382 | 11.47371 | 5 40 | 85 |
| 6 | 0 24 | .10453 | .99452 | .10510 | 9.51436 | .00551 | 9.56667 | 5 36 | 84 |
| 7 | 0 28 | .12187 | .99255 | .12278 | 8.14435 | .00751 | 8.20551 | 5 32 | 83 |
| 8 | 0 32 | .13917 | .99027 | .14054 | 7.11537 | .00983 | 7.18530 | 5 28 | 82 |
| 9 | 0 36 | .15643 | .98769 | .15838 | 6.31375 | .01247 | 6.39245 | 5 24 | 81 |
| 10 | 0 40 | .17365 | .98481 | .17633 | 5.67128 | .01543 | 5.75877 | 5 20 | 80 |
| 11 | 0 44 | 0.19081 | 0.98163 | 0.19438 | 5.14455 | 1.01872 | 5.24084 | 5 16 | 79 |
| 12 | 0 48 | .20791 | .97815 | .21256 | 4.70463 | .02234 | 4.80973 | 5 12 | 78 |
| 13 | 0 52 | .22495 | .97437 | .23087 | 4.33148 | .02630 | 4.44541 | 5 08 | 77 |
| 14 | 0 56 | .24192 | .97030 | .24933 | 4.01078 | .03061 | 4.13357 | 5 04 | 76 |
| 15 | 1 00 | .25882 | .96593 | .26795 | 3.73205 | .03528 | 3.86370 | 5 00 | 75 |
| 16 | 1 04 | .27564 | .96126 | .28675 | 3.48741 | .04030 | 3.62796 | 4 56 | 74 |
| 17 | 1 08 | .29237 | .95630 | .30573 | 3.27085 | .04569 | 3.42030 | 4 52 | 73 |
| 18 | 1 12 | .30902 | .95106 | .32492 | 3.07768 | .05146 | 3.23607 | 4 48 | 72 |
| 19 | 1 16 | .32557 | .94552 | .34433 | 2.90421 | .05762 | 3.07155 | 4 44 | 71 |
| 20 | 1 20 | .34202 | .93969 | .36397 | 2.74748 | .06418 | 2.92380 | 4 40 | 70 |
| 21 | 1 24 | 0.35837 | 0.93358 | 0.38386 | 2.60509 | 1.07115 | 2.79043 | 4 36 | 69 |
| 22 | 1 28 | .37461 | .92718 | .40403 | 2.47509 | .07853 | 2.66947 | 4 32 | 68 |
| 23 | 1 32 | .39073 | .92050 | .42447 | 2.35585 | .08636 | 2.55930 | 4 28 | 67 |
| 24 | 1 36 | .40674 | .91355 | .44523 | 2.24604 | .09464 | 2.45859 | 4 24 | 66 |
| 25 | 1 40 | .42262 | .90631 | .46631 | 2.14451 | .10338 | 2.36620 | 4 20 | 65 |
| 26 | 1 44 | .43837 | .89879 | .48773 | 2.05030 | .11260 | 2.28117 | 4 16 | 64 |
| 27 | 1 48 | .45399 | .89101 | .50953 | 1.96261 | .12233 | 2.20269 | 4 12 | 63 |
| 28 | 1 52 | .46947 | .88295 | .53171 | 1.88073 | .13257 | 2.13005 | 4 08 | 62 |
| 29 | 1 56 | .48481 | .87462 | .55431 | 1.80405 | .14335 | 2.06267 | 4 04 | 61 |
| 30 | 2 00 | .50000 | .86603 | .57735 | 1.73205 | .15470 | 2.00000 | 4 00 | 60 |
| 31 | 2 04 | 0.51504 | 0.85717 | 0.60086 | 1.66428 | 1.16663 | 1.94160 | 3 56 | 59 |
| 32 | 2 08 | .52992 | .84805 | .62487 | 1.60033 | .17918 | 1.88708 | 3 52 | 58 |
| 33 | 2 12 | .54464 | .83867 | .64941 | 1.53987 | .19236 | 1.83608 | 3 48 | 57 |
| 34 | 2 16 | .55919 | .82904 | .67451 | 1.48256 | .20622 | 1.78829 | 3 44 | 56 |
| 35 | 2 20 | .57358 | .81915 | .70021 | 1.42815 | .22077 | 1.74345 | 3 40 | 55 |
| 36 | 2 24 | .58779 | .80902 | .72654 | 1.37638 | .23607 | 1.70130 | 3 36 | 54 |
| 37 | 2 28 | .60182 | .79864 | .75355 | 1.32704 | .25214 | 1.66164 | 3 32 | 53 |
| 38 | 2 32 | .61566 | .78801 | .78129 | 1.27994 | .26902 | 1.62427 | 3 28 | 52 |
| 39 | 2 36 | .62932 | .77715 | .80978 | 1.23490 | .28676 | 1.58902 | 3 24 | 51 |
| 40 | 2 40 | .64279 | .76604 | .83910 | 1.19175 | .30541 | 1.55572 | 3 20 | 50 |
| 41 | 2 44 | 0.65606 | 0.75471 | 0.86929 | 1.15037 | 1.32501 | 1.52425 | 3 16 | 49 |
| 42 | 2 48 | .66913 | .74314 | .90040 | 1.11061 | .34563 | 1.49448 | 3 12 | 48 |
| 43 | 2 52 | .68200 | .73135 | .93252 | 1.07237 | .36733 | 1.46628 | 3 08 | 47 |
| 44 | 2 56 | .69446 | .71934 | 0.96569 | 1.03553 | .39016 | 1.43956 | 3 04 | 46 |
| 45 | 3 00 | 0.70711 | 0.70711 | 1.00000 | 1.00000 | 1.41421 | 1.41421 | 3 00 | 45 |
| | | Cos | Sin | Cot | Tan | Cosec | Sec | Time | Arc |
| | | | | | | | | ANGLE | |

**STANDARD TIMES**

LOCAL STANDARD TIME FOR EACH COUNTRY OR AREA
THE AHEAD OF ( + ) OR BEHIND ( - ) U.T. OR G.M.T

| Country or Area | Standard Time | L.S.T at 12h U.T or 17-30 I.S.T. | | Country or Area | Standard Time | L.S.T at 12h U.T or 17-30 I.S.T. | |
|---|---|---|---|---|---|---|---|
| | h | h | m | | h | h | m |
| Aden | + 3 | 15 | 00 | Belgium | + 1 | 13 | 00 |
| Afghanistan | + 4 1/2 | 16 | 30 | Belize | - 6Ψ | 06 | 00Ψ |
| Alaska | -9 | 03 | 00 | Bermuda | - 4 | 08 | 00 |
| - Day light Saving Time | - 8 | 04 | 00 | Bhutan | + 6 | 18 | 00 |
| Albania | + 1 | 13 | 00 | Bolivia | - 4 | 08 | 00 |
| - Day light Saving Time | + 2 | 14 | 00 | Brazil- | | | |
| Aleutian Islands | - 10 | 02 | 00 | Eastern (including coast) | - 3* | 09 | 00* |
| Algeria | 0 | 12 | 00 | Western | - 3* | 09 | 00* |
| Angola | + 1 | 13 | 00 | Territory of Acre | - 4* | 08 | 00* |
| Argentina | - 3 | 09 | 00 | Bulgaria | + 2 | 14 | 00 |
| Ascension Islands | 0 | 12 | 00 | Cambodia | + 7 | 19 | 00 |
| Australia- | | | | Cameroon | + 1 | 13 | 00 |
| Capital Territory (Canberra), Victoria, New South Wales, Queensland, Tasmania. | + 10 | 22 | 00 | Canada- Newfoundland | - 3 1/2* | 08 | 30* |
| South Australia, Northern Territory, Broken Hill Area | + 9 1/2 | 21 | 30 | East of Long. 63° W N W Territories (East of Long. 68° W), New Brunswick Nova Scotia, Prince Edward Island | - 4* | 08 | 00* |
| - Day light Saving Time | + 10 1/2 | 22 | 30 | | | | |
| Western Australia | + 8 | 20 | 00 | Quebec (West of Long.63°W), Ontario (East of Long 90° W) (Ottawa), Nunavut (East) and NW Territories ( Long.. W 68°-85° ) | - 5* | 07 | 00* |
| - Day light Saving Time | + 9 | 21 | 00 | | | | |
| Austral Islands | - 10 | 02 | 00 | Ontario (West of Long. 90° W), Manitoba, NW Territories (Long. W 85°-102°), East Saskatchewan, Nunavut (Central) | - 6* | 06 | 00* |
| Austria | + 1 | 13 | 00 | Alberta | - 7* | 05 | 00* |
| Azores | - 1 | 11 | 00 | Yukon Time | - 8 | 04 | 00 |
| Bahrain | + 3 | 15 | 00 | Canary Island | + 1 | 13 | 00 |
| Bangladesh | + 6 | 18 | 00 | Cape Verde Islands | - 1 | 11 | 00 |

## STANDARD TIMES

LOCAL STANDARD TIME FOR EACH COUNTRY OR AREA
THE AHEAD OF ( + ) OR BEHIND ( - ) U.T. OR G.M.T

| Country or Area | Standard Time | L.S.T at 12h U.T or 17-30 I.S.T. | | Country or Area | Standard Time | L.S.T at 12h U.T or 17-30 I.S.T. | |
|---|---|---|---|---|---|---|---|
| | h | h | m | | h | h | m |
| Caroline Islands- | + 11 | 23 | 00 | Ghana | 0 | 12 | 00 |
| Truk, Ponape | + 11 | 23 | 00 | Gibraltar | + 1↓ | 13 | 00↓ |
| Central African Republic | + 1 | 13 | 00 | Greece | + 2 | 14 | 00 |
| Chile | - 4* | 08 | 00* | Greenland | | | |
| China, People's Republic of | + 8 | 20 | 00 | Angmagssalik, W. Coast | - 3 | 09 | 00 |
| Cocos-keeling Islands | + 6 1/2 | 18 | 30 | Thule Area | - 4 | 08 | 00 |
| Colombia | - 5 | 07 | 00 | Guam | + 10 | 22 | 00 |
| Congo Republic | + 1 | 13 | 00 | Guatemala | - 6 | 06 | 00 |
| Cook Islands | - 10 | 02 | 00 | Guiana | | | |
| | | | | Dutch (Surinam) | - 3 | 09 | 00 |
| Corsica | + 1↓ | 13 | 00↓ | French | - 3 | 09 | 00 |
| Costa Rica | - 6 | 06 | 00 | Guyana Republic | - 4 | 08 | 00 |
| Croatia | +1 | 13 | 00 | Haiti | - 5 | 07 | 00 |
| Cuba | - 5* | 07 | 00* | Hawaiian Islands | - 10 | 02 | 00 |
| Czech Republic | +1 | 13 | 00 | Honduras | - 6 | 06 | 00 |
| Cyprus | + 2 | 14 | 00 | Hong Kong | + 8* | 20 | 00* |
| Dahomey Republic (Africa ) | + 1 | 13 | 00 | Hungary | + 1 | 13 | 00 |
| Denmark | + 1 | 13 | 00 | Iceland | 0 | 12 | 00 |
| Ecuador | - 5 | 07 | 00 | India | + 5 1/2 | 17 | 30 |
| Egypt | + 2* | 14 | 00* | Indonesia, Republic of- | -- | -- | |
| Estonia | + 2 | 14 | 00 | Sumatra, Java, West & Central Kalimantan | + 7 | 19 | 00 |
| El Salvador | - 6 | 06 | 00 | Bali, South & East Kalimantan | + 8 | 20 | 00 |
| Ethiopia | + 3 | 15 | 00 | Irian Jaya, Maluku | + 9 | 21 | 00 |
| Falkland Islands | -4 | 08 | 00 | Iran | + 3 1/2 | 15 | 30 |
| Fiji | +12 | 24 | 00 | Iraq | + 3 | 15 | 00 |
| Finland | +2 | 14 | 00 | Ireland, Republic of | 0 | 12 | 00 |
| France | +1↓ | 13 | 00↓ | Israel | +2 | 14 | 00 |
| Germany | +1 | 13 | 00 | Italy | +1* | 13 | 00* |

**STANDARD TIMES**

LOCAL STANDARD TIME FOR EACH COUNTRY OR AREA
THE AHEAD OF ( + ) OR BEHIND ( - ) U.T. OR G.M.T

| Country or Area | Standard Time | L.S.T at 12h U.T or 17-30 I.S.T. | | Country or Area | Standard Time | L.S.T at 12h U.T or 17-30 I.S.T. | |
|---|---|---|---|---|---|---|---|
| | h | h | m | | h | h | m |
| Ivory Coast | 0 | 12 | 00 | Monaco | + 1 | 13 | 00 |
| Japan (and Japan Is.) | + 9 | 21 | 00 | Mongolia | + 8 | 20 | 00 |
| Jordan | + 2 | 14 | 00 | Morocco | 0* | 12 | 00* |
| Kenya | + 3 | 15 | 00 | Mozambique | + 2 | 14 | 00 |
| Korea (North & South ) | + 9 | 21 | 00 | Nepal | + 5 3/4 | 17 | 45 |
| Kuwait | + 3 | 15 | 00 | Netherlands (Holland) | + 1 | 13 | 00 |
| Laos | + 7 | 19 | 00 | New Caledonia | + 11 | 23 | 00 |
| Latvia | + 2 | 14 | 00 | New Hebrides | + 11 | 23 | 00 |
| Lebanon | + 2* | 14 | 00* | New Zealand | + 12 | 24 | 00 |
| Liberia | 0 | 12 | 00 | Nicaragua | - 6 | 06 | 00 |
| Libya | + 2 | 14 | 00 | Niger | + 1 | 13 | 00 |
| Lithuania | + 3 | 15 | 00 | Nigeria | + 1 | 13 | 00 |
| Luxembourg | + 1↓ | 13 | 00↓ | Norfolk Island | + 11 1/2 | 23 | 30 |
| Madagascar | + 3 | 15 | 00 | Norway | + 1* | 13 | 00* |
| Madeira | - 1* | 11 | 00* | Oman (Masira, Muscat, Salalah) | + 4 | 16 | 00 |
| Malawi | + 2 | 14 | 00 | Pakistan | + 5 | 17 | 00 |
| Malaysia | + 8 | 20 | 00 | Papua New Guinea | + 10 | 22 | 00 |
| Maldives Island | + 5 | 17 | 00 | Paraguay | - 4 | 08 | 00 |
| Malta | + 1 | 13 | 00 | Peru | - 5 | 07 | 00 |
| Manchuria (China) | + 8 | 20 | 00 | Philippines | + 8 | 20 | 00 |
| Mariana Island | + 10 | 22 | 00 | Poland | + 1* | 13 | 00* |
| Marquesas Islands | - 9 1/2 | 02 | 30 | Portugal | + 1 | 13 | 00 |
| Marshall Islands | + 12 | 24 | 00 | Puerto Rico | - 4 | 08 | 00 |
| Mauritania | 0 | 12 | 00 | Reunion | + 4 | 16 | 00 |
| Mauritius | + 4 | 16 | 00 | Romania | + 2 | 14 | 00 |
| Mayanmar | + 6 1/2 | 18 | 30 | Sakhalin | + 11 | 23 | 00 |
| Mexico- | | | | Samoa | - 11 | 01 | 00 |
| Mexico City | - 6 | 06 | 00 | Sardinia | + 1 | 13 | 00 |
| Sonora, Sinaloa, Nayarit, Baja California Sur | - 7 | 05 | 00 | | | | |
| Baja California | - 8 | 04 | 00 | | | | |

**STANDARD TIMES**

LOCAL STANDARD TIME FOR EACH COUNTRY OR AREA
THE AHEAD OF ( + ) OR BEHIND ( - ) U.T. OR G.M.T

| Country or Area | Standard Time | L.S.T at 12h U.T or 17-30 I.S.T. | | Country or Area | Standard Time | L.S.T at 12h U.T or 17-30 I.S.T. | |
|---|---|---|---|---|---|---|---|
| | h | h | m | | h | h | m |
| Saudi Arabia- | | | | Tangier | 0 | 12 | 00 |
| Jeddah | + 3 | 15 | 00 | Thailand | + 7 | 19 | 00 |
| Dhahran | + 4 | 16 | 00 | Uganda | + 3 | 15 | 00 |
| Senegal | 0 | 12 | 00 | Ukraine | + 2 | 14 | 00 |
| Serbia | + 1 | 13 | 00 | United Arab Emirates | + 4 | 16 | 00 |
| Sierra Leone | 0 | 12 | 00 | USA Aleutian | - 10* | 02 | 00* |
| Singapore | + 8 | 20 | 30 | USA Hawaii | - 10* | 02 | 00* |
| Solomon Islands | + 11 | 23 | 00 | USA Pacific | - 8* | 04 | 00* |
| Somalia | + 3 | 15 | 00 | USA Mountain | - 7* | 05 | 00* |
| South Africa | + 2 | 14 | 00 | USA Arizona | - 7* | 05 | 00* |
| Spain | + 1↓ | 13 | 00↓ | USA Central | - 6* | 06 | 00* |
| Sri Lanka | + 5 1/2 | 17 | 30 | USA Eastern | - 5* | 07 | 00* |
| Sudan | + 2 | 14 | 00 | Uruguay | - 3 | 09 | 00 |
| Sweden | + 1 | 13 | 00 | Uzbekistan | + 5 | 17 | 00 |
| Switzerland | + 1 | 13 | 00 | Zambia | + 2 | 14 | 00 |
| Syria | + 2* | 14 | 00* | Zimbabwe | + 2 | 14 | 00 |
| Tanzania | + 3 | 15 | 00 | | | | |

* During summer seasons clock time differs from Standard time.
Ψ Winter time may be kept in these countries.
↓ This time is used throughout the year, but may differ from legal time.

# PART - VI

## INDIAN CALENDAR
## AND
## EXPLANATION

# INDIAN CALENDAR
# EXPLANATORY NOTE

The astronomical data included in this section on Indian Calendar have been calculated in accordance with the recommendations of the Calendar Reform Committee, as outlined in its report, and the calculations have been done on the basis of the positions of the Sun, Moon and Planets, as contained in the main tables of the Ephemeris. However, the information on Luni- Solar Calendar in this section have been calculated on the basis of traditional Nirayana Calendric system following the Government's decision not to disturb the traditional procedure in fixing the days of religious festivals. Certain additional data, which are required for the compilation of an Indian Panchang (Almanac), have also been furnished to meet the requirements of the numerous Panchang makers of this country. The tables of this section have been extended beyond December, 2021 and materials up to April 20, 2022 have been furnished in order to facilitate preparation of Almanacs for one complete Indian year. The longitudes of the Sun, Moon and Planets and certain other data relating to their positions for the period of 2022 covered by this calendar have also been given in separate table for the same purpose.

All calculations contained in this section have been done for an adopted Central Station of India situated at $82^0 30'$ longitude East of Greenwich and $23^0 11'$ latitude North (latitude of Ujjain ) and accordingly the timings have been expressed in the local mean time of this Central Station, which is also the Indian Standard Time. This time (I.S.T.) is $5^h 30^m$ ahead on the Universal Time or Greenwich Mean Time.

The Calendar used in this section is the "National Calendar" of India as recommended by the Calendar Reform Committee and introduced by the Government of India with effect from the 22 nd March 1957, corresponding to the 1st of Chaitra, 1879 Saka Era. Thereafter, Govt. of India has decided to introduce an all India Nirayana Solar Calendar in addition to the existing National Calendar. This new Calendar has been introduced with effect from 14th April, 2004 corresponding to 1st Vaisakha of 5105 Kali, Kali Era being the Era of this new Calendar and this Calendar have fixed number of days for its months. Dates of the Nirayana Calendar have been indicated in addition to the existing National Calendar. The months of these Calendars, the number of days assigned to each month of the two Calendars, and the dates of the Gregorian calendar corresponding to the first day of each month of both the Calendars are as follows :-

| Months of the National Calendar | Gregorian date for 1st of the month | Months of the Nirayana Calendar | Gregorian date for 1st of the month |
|---|---|---|---|
| Chaitra (30 days ; 31 days in a leap-year) | March 22 ( March 21 in a leap-year) | Vaisakha (31 days) | April 14 |
| | | Jyaishtha (31 days) | May 15 |
| Vaisakha (31 days) | April 21 | Ashadha (31 days) | June 15 |
| Jyaishtha (31 days) | May 22 | Sravana (31 days) | July 16 |
| Ashadha (31 days) | June 22 | Bhadra (31 days) | August 16 |
| Sravana (31 days) | July 23 | Asvina (30 days) | September 16 |
| Bhadra (31 days) | August 23 | Kartika (30 days) | October 16 |
| Asvina (30 days) | September 23 | Agrahayana (30 days) | November 15 |
| Kartika (30 days) | October 23 | Pausha (30 days) | December 15 |
| Agrahayana (30 days) | November 22 | Magha (30 days) | January 14 |
| Pausha (30 days) | December 22 | Phalguna (30 days ; 31 days in a leap-year) | February 13 |
| Magha (30 days) | January 21 | | |
| Phalguna (30 days) | February 20 | Chaitra (30 days) | March 15 |

Different items included in this section are elaborated below :-

The Sunrise and Sunset times, calculated for the Central Station, relate respectively to the appearance and disappearance of the upper limb of the Sun on the horizon. The amount of horizontal refraction taken for this purpose is $31'$ and the semi-diameter of the Sun as $16'$, so that at the given times of Sunrise and Sunset, the centre of the Sun actually $47'$ below the horizon.

The apparent noon is the local mean time of the sun's meridian passage, i.e., the mid-day reduced to the above standard meridian of India ($82\frac{1}{2}^0$ E. Longitude).

The ending moments of tithis, nakshatras and yogas have been given in Indian Standard Time and shown against their ordinal numbers. The phenomena being geocentric ones, their timings in I.S.T. are applicable for the whole of India without any modification. These timings reduced by a deduction of $5^h 30^m$ would give the G.M.T. applicable for all places on the earth.

The tithi is based on the difference of longitude of the Moon and that of the Sun. A tithi is completed when the longitude of the Moon gains exactly $12^0$ or its integral multiple on that of the Sun and as such there are 30 tithis in lunar month. A difference in longitude of $12^0$ indicates the ending of the 1st tithi, $24^0$ that of the 2nd tithi and so on. The number of tithis have been shown from Sukla 1 to Sukla 15 (full-moon) and again from Krishna 1 to Krishna 14 and Krishna 30 (new moon), using the symbols S and K for Sukla paksha (waxing Moon)and Krishna paksha (waning Moon) respectively.

A nakshatra is completed when the nirayana longitude of the Moon as measured from the initial point attains a value of $13° 20'$ or an integral multiple thereof. When this longitude is $13° 20'$ the 1st nakshatra ends and so on. There are thus 27 nakshatras in a sidereal month and the nakshatra divisions occupy fixed positions in the sphere of stars. In the case of the Sun the calculation also has been done on the same basis. But in this case, the time of Sun's entry into a nakshatra-division has been stated, whereas in the case of the Moon, the time of its exit from the division has been given.

Like nakshatras, there are 27 yogas. Yoga is calculated from the sum of nirayana longitudes of the Sun and the Moon. When the sum amounts to $13° 20'$, the first yoga ends; when it amounts to $26° 40'$, the second yoga ends, and so on. Thus, in all 27 yogas cover 360°. Names of the nakshatras and yogas have been given at the bottom of the table. It will be seen that two of the names Vyatipata and Vaidhriti occur also under Phenomena, where they have been treated as special yogas and calculated by a somewhat different rule. The 27 yogas which have got very little astronomical significance have been included in this publication only to meet the needs of Panchang where the yoga is also one of the components.

For the purpose of calculation of rasis, nakshatras and yogas, an initial point which occupies a fixed position on the ecliptic has been adopted as the origin for the measurement of longitudes. The position of this initial point coincides with the vernal equinoctial point of vernal equinox day of 285 A.D. For the purpose of assigning a precise position to it, the tropical longitude of this initial point has been adopted as $23° 15' 00''$ for $0^h$ on 21st March, 1956. The tropical longitude of this fixed initial point for any day is known as ayanamsa. The longitude of a celestial body measured from this initial point is known as nirayana longitude.

The entry into different rasis of the Moon and of the Sun have been shown at the bottom of the relevant pages of the calendar and the calculations have been done on the same basis as in the case of nakshatras, utilising the nirayana longitudes. Rasis, which cover arc of $30^0$ of the zodiac belt, are measured along the ecliptic from the above-mentioned initial point.

The tithi, nakshatra and yoga as are current at Sunrise at the Central Station, have been shown against the date with their ending moments in I. S. T. When the time of these or any other phenomena falls after midnight and before the next Sunrise, the time has been expressed after adding $24^h$ to the I.S.T. without changing the date after midnight in order to maintain continuity of time-reckoning from one Sunrise to the next, in conformity with the system followed in Indian religious calendars.

The solar months recommended for the religious calendar, such as, Saura Vaisakha, Saura Jyaishtha, etc., by the Calendar Reform Committee in 1955 have been reckoned from the moments when the apparent longitude of the Sun equals $23° 15'$, $53° 15'$ and so on. The calculation for this purpose thus has not been done with a variable ayanamsa, as in the case of rasis and nakshatras, but with a fixed ayanamsa of $23° 15'$. These months are shown for purpose of illustration only, but are not used in practice for actual luni-solar adjustment.

The lunar months for determining the dates of religious festivals are reckoned from one New-Moon to the next (Sukladi system or mukhya mana). The lunar month for this purpose is named after the Nirayana or Sidereal solar month in which the initial New-Moon from which the month starts, falls.

Phenomena mentioned in the table include New-Moon, Full-Moon, Sayana Vyatipata (when the sum of the tropical longitudes of the Sun and the Moon equals $180^0$), Sayana Vaidhriti (when the above sum amounts to $360^0$), eclipses, heliacal rising and setting of Venus, Mars and Jupiter and Jupiterøs transit into rasis.

The principal festivals of different states have been fixed on the basis of the criterion stated here, but in doing so, the rules and conventions of the states concerned have been followed as far as practicable.

## LIST OF HOLIDAYS

The list of holidays for the Government of India as well as for the State Governments have been prepared in a consolidated form and the dates fixed for them, have been shown in a separate table under the head ôPrincipal Festivals for Holidaysö. The principal festivals of Moslems, Parsis, Jewish and Christians have also been shown separately.

## AYANAMSA

The value of ayanamsa has been given in the calendar for the first day of the month and also in a separate table at the end at interval of three days.

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The Sayana Vyatipata and Sayana Vaidhriti, reported under the column ñPhenomenaò, are calculated on the basis of defination given in the report of Calendar Reform Committee. These are classified as the Calendar Reform Committee view and no way related to the ómahapata yogaô defined in some Indian traditional texts (siddhantic treatises).

## HELIACAL RISING AND SETTING OF PLANETS, 2022
(JANUARY TO APRIL)

| Planet | National Date | | Nirayana Date | | Gregorian Date | | Time (I.S.T) | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | h | m |
| Mercury sets in the West | Pausha | 28,1943 Saka | Magha | 5, 5122 Kali | Jan. | 18, 2022 | 25 | 55 |
| Mercury rises in the East | Magha | 7,1943 Saka | Magha | 14, 5122 Kali | Jan. | 27, 2022 | 26 | 00 |
| Mercury sets in the East | Phalguna | 23,1943 Saka | Phalguna | 30, 5122 Kali | Mar. | 14, 2022 | 21 | 46 |
| Mercury rises in the West | Chaitra | 22,1944 Saka | Chaitra | 29, 5122 Kali | Apr. | 2, 2022 | 10 | 05 |
| Venus sets in the West | Pausha | 15,1943 Saka | Pausha | 22, 5122 Kali | Jan. | 5, 2022 | 27 | 36 |
| Venus rises in the East | Pausha | 21,1943 Saka | Pausha | 28, 5122 Kali | Jan. | 11, 2022 | 14 | 00 |
| Jupiter sets in the West | Phalguna | 3,1943 Saka | Phalguna | 10, 5122 Kali | Feb. | 22, 2022 | 15 | 48 |
| Jupiter rises in the East | Chaitra | 2,1944 Saka | Chaitra | 9, 5122 Kali | Mar.. | 23, 2022 | 13 | 26 |
| Saturn sets in the West | Magha | 2,1943 Saka | Magha | 9, 5122 Kali | Jan. | 22, 2022 | 09 | 44 |
| Saturn rises in the East | Phalguna | 4,1943 Saka | Phalguna | 11, 5122 Kali | Feb. | 23, 2022 | 28 | 38 |

N.B.- Here East means the eastern horizon or west of the Sun and West means the western horizon or east of the Sun.

## RETROGRESSION OF PLANETS, 2022
(JANUARY TO APRIL)

| Planet | | National Date | | Nirayana Date | | Gregorian Date | | Time (I.S.T) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | h | m |
| Mercury | Retrograde | Pausha | 24,1943 Saka | Magha | 1,5122 Kali | Jan. | 14,2022 | 17 | 09 |
| Mercury | Direct | Magha | 15,1943 Saka | Magha | 22,5122 Kali | Feb. | 4,2022 | 9 | 57 |
| Venus | Direct | Magha | 9,1943 Saka | Magha | 16,5122 Kali | Jan. | 29,2022 | 14 | 18 |
| Uranus | Direct | Pausha | 28,1943 Saka | Magha | 5,5122 Kali | Jan. | 18,2022 | 20 | 58 |

## MEAN RAHU, 2022

| Date | | Longitude | Date | | Longitude | Date | | Longitude |
|---|---|---|---|---|---|---|---|---|
| | | 0 / // | | | 0 / // | | | 0 / // |
| Jan. | -2 | 35 31 45 | Feb. | 7 | 33 24 34 | Mar. | 19 | 31 17 24 |
| | 8 | 34 59 58 | | 17 | 32 52 47 | | 29 | 30 45 36 |
| | 18 | 34 28 10 | | 27 | 32 20 59 | Apr. | 8 | 30 13 48 |
| Jan. | 28 | 33 56 22 | Mar. | 9 | 31 49 11 | | 18 | 29 42 00 |
| | | | | | | | 28 | 29 10 13 |

## ECLIPSES, 2022
(JANUARY TO APRIL)

Partial Solar eplipse on 30th April,2022 (Not visible in India).

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**INDIAN CALENDAR**

SAKA ERA 1942

Makara : Tapas

Month of PAUSHA (30 days)

Winter (Sisira), 1st Month

(*Nirayana*) 8 Pausha, 5121 Kali Era to (*Nirayana*) 7 Magha, 5121 Kali Era

| Date | Week Day | Gregorian Date | | Sunrise | | Apparent Noon | | Sunset | | Tithi No. | | Tithi Ending Moment | | Nakshatra No. | Nakshatra Ending Moment | | Yoga No. | Yoga Ending Moment | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | h | m | h | m | h | m | | | h | m | | h | m | | h | m |
| | | 2020 A.D. | | | | | | | | | | | | | | | | | |
| 1 | Tue | Dec. | 22 | 6 | 37.7 | 11 | 58.7 | 17 | 19.9 | S | 8 | 18 | 14.8 | 26 | 25 | 37.4 | 17 | 12 | 09.3 |
| 2 | Wed | | 23 | 6 | 38.2 | 11 | 59.2 | 17 | 20.4 | | 9 | 20 | 39.9 | 27 | 28 | 32.8 | 18 | 12 | 48.8 |
| 3 | Thu | | 24 | 6 | 38.6 | 11 | 59.7 | 17 | 21.0 | S | 10 | 23 | 17.7 | 1 | - | - | 19 | 13 | 40.7 |
| 4 | Fri | | 25 | 6 | 39.1 | 12 | 00.2 | 17 | 21.5 | | 11 | 25 | 54.7 | 1 | 7 | 36.3 | 20 | 14 | 35.5 |
| 5 | Sat | | 26 | 6 | 39.5 | 12 | 00.7 | 17 | 22.1 | | 12 | 28 | 18.8 | 2 | 10 | 35.3 | 21 | 15 | 24.4 |
| 6 | Sun | | 27 | 6 | 39.9 | 12 | 01.2 | 17 | 22.7 | | 13 | 30 | 20.8 | 3 | 13 | 19.0 | 22 | 15 | 59.9 |
| 7 | Mon | | 28 | 6 | 40.3 | 12 | 01.6 | 17 | 23.3 | | 14 | - | - | 4 | 15 | 39.5 | 23 | 16 | 16.7 |
| 8 | Tue | | 29 | 6 | 40.7 | 12 | 02.1 | 17 | 23.9 | | 14 | 7 | 54.8 | 5 | 17 | 32.1 | 24 | 16 | 11.5 |
| 9 | Wed | | 30 | 6 | 41.0 | 12 | 02.6 | 17 | 24.5 | S | 15 | 8 | 58.2 | 6 | 18 | 55.0 | 25 | 15 | 42.9 |
| 10 | Thu | | 31 | 6 | 41.3 | 12 | 03.1 | 17 | 25.1 | K | 1 | 9 | 30.7 | 7 | 19 | 48.8 | 26 | 14 | 51.0 |
| 11 | Fri | Jan. | 1 | 6 | 41.6 | 12 | 03.6 | 17 | 25.8 | | 2 | 9 | 33.9 | 8 | 20 | 15.2 | 27 | 13 | 36.9 |
| 12 | Sat | | 2 | 6 | 41.9 | 12 | 04.0 | 17 | 26.4 | | 3 | 9 | 10.4 | 9 | 20 | 16.9 | 1 | 12 | 02.5 |
| 13 | Sun | | 3 | 6 | 42.2 | 12 | 04.5 | 17 | 27.1 | | 4 | 8 | 22.9 | 10 | 19 | 56.6 | 2 | 10 | 09.6 |
| 14 | Mon | | 4 | 6 | 42.4 | 12 | 04.9 | 17 | 27.7 | | 5 | 7 | 14.3 | 11 | 19 | 17.0 | 3 | 8 | 00.4 |
| | | | | | | | | | | | (6 | 29 | 47.3) | | | | 4 | 29 | 36.6 |
| 15 | Tue | | 5 | 6 | 42.7 | 12 | 05.4 | 17 | 28.4 | | 7 | 28 | 04.2 | 12 | 18 | 20.6 | 5 | 27 | 00.0 |
| 16 | Wed | | 6 | 6 | 42.9 | 12 | 05.8 | 17 | 29.1 | | 8 | 26 | 07.0 | 13 | 17 | 09.4 | 6 | 24 | 12.2 |
| 17 | Thu | | 7 | 6 | 43.1 | 12 | 06.3 | 17 | 29.8 | | 9 | 23 | 58.3 | 14 | 15 | 45.8 | 7 | 21 | 14.8 |
| 18 | Fri | | 8 | 6 | 43.2 | 12 | 06.7 | 17 | 30.5 | K | 10 | 21 | 40.6 | 15 | 14 | 12.4 | 8 | 18 | 10.0 |
| 19 | Sat | | 9 | 6 | 43.4 | 12 | 07.1 | 17 | 31.2 | | 11 | 19 | 17.5 | 16 | 12 | 32.3 | 9 | 15 | 00.3 |
| 20 | Sun | | 10 | 6 | 43.5 | 12 | 07.5 | 17 | 31.9 | | 12 | 16 | 53.1 | 17 | 10 | 49.6 | 10 | 11 | 49.0 |
| 21 | Mon | | 11 | 6 | 43.6 | 12 | 07.9 | 17 | 32.6 | | 13 | 14 | 32.9 | 18 | 9 | 09.3 | 11 | 8 | 39.8 |
| | | | | | | | | | | | | | | | | | (12 | 29 | 37.5) |
| 22 | Tue | | 12 | 6 | 43.6 | 12 | 08.3 | 17 | 33.3 | | 14 | 12 | 23.0 | 19 | 7 | 37.7 | 13 | 26 | 47.2 |
| | | | | | | | | | | | | | | (20 | 30 | 21.5) | | | |
| 23 | Wed | | 13 | 6 | 43.7 | 12 | 08.7 | 17 | 34.0 | K | 30 | 10 | 30.2 | 21 | 29 | 28.0 | 24 | 24 | 14.4 |
| 24 | Thu | | 14 | 6 | 43.7 | 12 | 09.1 | 17 | 34.7 | S | 1 | 09 | 01.9 | 22 | 29 | 04.4 | 22 | 22 | 04.5 |
| 25 | Fri | | 15 | 6 | 43.7 | 12 | 09.4 | 17 | 35.4 | | 2 | 8 | 05.2 | 23 | 29 | 16.8 | 20 | 20 | 22.2 |
| 26 | Sat | | 16 | 6 | 43.7 | 12 | 09.8 | 17 | 36.2 | | 3 | 7 | 46.2 | 24 | 30 | 09.3 | 19 | 19 | 11.1 |
| 27 | Sun | | 17 | 6 | 43.6 | 12 | 10.1 | 17 | 36.9 | | 4 | 8 | 08.9 | 25 | - | - | 18 | 18 | 32.8 |
| 28 | Mon | | 18 | 6 | 43.5 | 12 | 10.4 | 17 | 37.6 | S | 5 | 9 | 14.4 | 25 | 7 | 43.0 | 18 | 18 | 26.2 |
| 29 | Tue | | 19 | 6 | 43.5 | 12 | 10.7 | 17 | 38.3 | | 6 | 10 | 59.2 | 26 | 9 | 54.6 | 18 | 18 | 47.5 |
| 30 | Wed | | 20 | 6 | 43.3 | 12 | 11.0 | 17 | 39.0 | S | 7 | 13 | 15.5 | 27 | 12 | 36.3 | 21 | 19 | 29.7 |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

SAKA ERA 1942

Uttarayana
Dakshina Gola

Month of PAUSHA (30 days)

Ayanamsa on 1st : 24° 08′ 44″

(*Nirayana*) 8 Pausha, 5121 Kali Era to (*Nirayana*) 7 Magha, 5121 Kali Era

| Date | Gregorian Date | Solar Month | Lunar Month | Transit of the Sun | Phenomena | Festivals |
|---|---|---|---|---|---|---|
| | 2020A.D. | | | | | |
| 1 | Dec. 22 | SAURA PAUSHA | CHANDRA MARGASIRSHA | | | |
| 2 | 23 | | | | | |
| 3 | 24 | | | | | |
| 4 | 25 | | | | | 4- Mauna Ekadasi(Jain), Gita jayanti, Vaikuntha Ekadasi (S India), Mokshada Ekadasi, Birthday of Sadhu T.L. Vaswani (Sindhi) |
| 5 | 26 | | | | | 5- Akhanda Dvadasi, Jor mela-3 days (Punjab) |
| 6 | 27 | | | | | |
| 7 | 28 | | | 7- Enters Purvashadha nak(23ʰ45ᵐ.0) | 7- Sayana Vaidhriti (25ʰ20ᵐ.4) | |
| 8 | 29 | | | | | 8- Shri Dutta Jayanti(Maharastra), Dutta Treya Jayanti. |
| 9 | 30 | | | | 9- Full Moon (8ʰ58ᵐ.2) | 9- Margi Purnima, Arudra Darshanam (Purvarunodaya) (S. India) |
| 10 | 31 | | | | | |
| 11 | Jan. 1 | | | | | |
| 12 | 2 | | | | | |
| 13 | 3 | | | | | |
| 14 | 4 | | | | | |
| 15 | 5 | | | | | |
| 16 | 6 | | | | | 16- Ashtaka (Pupashtaka) |
| 17 | 7 | | | | | |
| 18 | 8 | | | | | 18- Birthday of Parsvanath(Jain) |
| 19 | 9 | | | | | 19- Saphla Ekadasi. |
| 20 | 10 | | | 20- Enters Uttarashadha (25ʰ45ᵐ.4) | 20- Sayana Vyatipata (9ʰ16ᵐ.9) | |
| 21 | 11 | | | | | |
| 22 | 12 | | | | | 22-Vahula Amavasya (Odisha). |
| 23 | 13 | | | 23- Saura Maghadi (11ʰ08ᵐ.0) | 23- New Moon (11ʰ30ᵐ.2) | 23- Lohri (Punjab, J&K), Bhogi (S. India). |
| 24 | 14 | | CHANDRA PAUSHA | | | 24- Birthday of Sant Paramanand (Sindhi), Magha Bihu (Assam), Makara Samkranti (N. India), Makara Samkranti (Bengal), Pongal (S. India), Makara Snana, Tila Samkranti, Tai Pongal (Kerala). |
| 25 | 15 | SAURA MAGHA | | | | 25- Mattu Pongal or Kanumu(S. India). |
| 26 | 16 | | | | | |
| 27 | 17 | | | | 27- Jupiter sets in the East (26ʰ45ᵐ) | |
| 28 | 18 | | | | | |
| 29 | 19 | | | 29- Enters Tropical Aquarius(26ʰ09ᵐ8) | | |
| 30 | Jan. 20 | | | | | 30- Guru Govind Singh's Birthday. |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.
Moon enters :- Mesha 2, 28ʰ 32ᵐ.8; Vrisha 5, 17ʰ 18ᵐ.0; Mithuna 7, 28ʰ 39ᵐ.5; Karkata 10, 13ʰ 38ᵐ.0; Simha 12, 20ʰ 16ᵐ.9; Kanya 14, 25ʰ 04ᵐ.4; Tula 16, 28ʰ 29ᵐ.1; Vrischika 19, 6ʰ 57ᵐ.7; Dhanus 21, 9ʰ 09ᵐ.3; Makara 23, 12ʰ 05ᵐ.7; Kumbha 25, 17ʰ 05ᵐ.9; Mina 27, 25ʰ 15ᵐ.9; Mesha 30, 12ʰ 36ᵐ.3; Sun enters :- Nirayana Makara 24, 8ʰ 14ᵐ.9.

# INDIAN CALENDAR

SAKA ERA 1942

Kumbha : Tapasya

Month of MAGHA (30 days)

Winter (Sisira), 2nd Month

(*Nirayana*) 8 Magha, 5121 Kali Era to (*Nirayana*) 7 Phalguna, 5121 Kali Era

| Date | Week Day | Gregorian Date | | Sunrise | | Apparent Noon | | Sunset | | Tithi No. | | Tithi Ending Moment | | Nakshatra No. | Nakshatra Ending Moment | | Yoga No. | Yoga Ending Moment | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | h | m | h | m | h | m | | | h | m | | h | m | | h | m |
| | | 2021 A.D. | | | | | | | | | | | | | | | | | |
| 1 | Thu | Jan. | 21 | 6 | 43.2 | 12 | 11.3 | 17 | 39.7 | S | 8 | 15 | 50.7 | 1 | 15 | 36.3 | 22 | 20 | 23.4 |
| 2 | Fri | | 22 | 6 | 43.0 | 12 | 11.6 | 17 | 40.4 | | 9 | 18 | 29.6 | 2 | 18 | 40.1 | 23 | 21 | 18.0 |
| 3 | Sat | | 23 | 6 | 42.8 | 12 | 11.8 | 17 | 41.2 | S | 10 | 20 | 56.7 | 3 | 21 | 32.5 | 24 | 22 | 02.8 |
| 4 | Sun | | 24 | 6 | 42.6 | 12 | 12.1 | 17 | 41.9 | | 11 | 22 | 58.4 | 4 | 24 | 00.8 | 25 | 22 | 28.3 |
| 5 | Mon | | 25 | 6 | 42.4 | 12 | 12.3 | 17 | 42.6 | | 12 | 24 | 25.0 | 5 | 25 | 55.5 | 26 | 22 | 27.8 |
| 6 | Tue | | 26 | 6 | 42.1 | 12 | 12.5 | 17 | 43.2 | | 13 | 25 | 11.6 | 6 | 27 | 11.7 | 27 | 21 | 57.2 |
| 7 | Wed | | 27 | 6 | 41.8 | 12 | 12.7 | 17 | 43.9 | | 14 | 25 | 17.7 | 7 | 27 | 49.1 | 1 | 20 | 55.6 |
| 8 | Thu | | 28 | 6 | 41.5 | 12 | 12.9 | 17 | 44.6 | S | 15 | 24 | 46.2 | 8 | 27 | 50.5 | 2 | 19 | 24.2 |
| 9 | Fri | | 29 | 6 | 41.2 | 12 | 13.1 | 17 | 45.3 | K | 1 | 23 | 42.4 | 9 | 27 | 21.2 | 3 | 17 | 26.7 |
| 10 | Sat | | 30 | 6 | 40.9 | 12 | 13.3 | 17 | 46.0 | | 2 | 22 | 13.0 | 10 | 26 | 28.0 | 4 | 15 | 07.5 |
| 11 | Sun | | 31 | 6 | 40.5 | 12 | 13.4 | 17 | 46.7 | | 3 | 20 | 25.1 | 11 | 25 | 17.9 | 5 | 12 | 31.8 |
| 12 | Mon | Feb. | 1 | 6 | 40.1 | 12 | 13.6 | 17 | 47.3 | | 4 | 18 | 25.3 | 12 | 23 | 57.4 | 6 | 9 | 44.8 |
| 13 | Tue | | 2 | 6 | 39.7 | 12 | 13.7 | 17 | 48.0 | K | 5 | 16 | 19.6 | 13 | 22 | 32.4 | 7 | 6 | 51.4 |
| | | | | | | | | | | | | | | | | | (8 | 27 | 55.5) |
| 14 | Wed | | 3 | 6 | 39.2 | 12 | 13.8 | 17 | 48.6 | | 6 | 14 | 12.6 | 14 | 21 | 07.3 | 9 | 25 | 00.2 |
| 15 | Thu | | 4 | 6 | 38.8 | 12 | 13.9 | 17 | 49.3 | | 7 | 12 | 07.9 | 15 | 19 | 45.3 | 10 | 22 | 07.8 |
| 16 | Fri | | 5 | 6 | 38.3 | 12 | 14.0 | 17 | 49.9 | | 8 | 10 | 07.7 | 16 | 18 | 28.3 | 11 | 19 | 19.7 |
| 17 | Sat | | 6 | 6 | 37.8 | 12 | 14.0 | 17 | 50.5 | | 9 | 8 | 13.5 | 17 | 17 | 17.7 | 12 | 16 | 36.7 |
| | | | | | | | | | | (K | 10 | 30 | 26.5) | | | | | | |
| 18 | Sun | | 7 | 6 | 37.3 | 12 | 14.1 | 17 | 51.2 | | 11 | 28 | 48.0 | 18 | 16 | 14.6 | 13 | 13 | 59.9 |
| 19 | Mon | | 8 | 6 | 36.8 | 12 | 14.1 | 17 | 51.8 | | 12 | 27 | 20.0 | 19 | 15 | 20.8 | 14 | 11 | 30.4 |
| 20 | Tue | | 9 | 6 | 36.2 | 12 | 14.2 | 17 | 52.4 | | 13 | 26 | 05.8 | 20 | 14 | 38.6 | 15 | 9 | 10.1 |
| 21 | Wed | | 10 | 6 | 35.7 | 12 | 14.2 | 17 | 53.0 | | 14 | 25 | 09.4 | 21 | 14 | 11.9 | 16 | 7 | 01.3 |
| | | | | | | | | | | | | | | | | | (17 | 29 | 07.4) |
| 22 | Thu | | 11 | 6 | 35.1 | 12 | 14.2 | 17 | 53.6 | K | 30 | 24 | 35.7 | 22 | 14 | 05.0 | 18 | 27 | 32.1 |
| 23 | Fri | | 12 | 6 | 34.5 | 12 | 14.2 | 17 | 54.2 | S | 1 | 24 | 30.0 | 23 | 14 | 23.2 | 19 | 26 | 19.2 |
| 24 | Sat | | 13 | 6 | 33.8 | 12 | 14.2 | 17 | 54.8 | | 2 | 24 | 57.0 | 24 | 15 | 11.3 | 20 | 25 | 31.7 |
| 25 | Sun | | 14 | 6 | 33.2 | 12 | 14.1 | 17 | 55.4 | | 3 | 25 | 59.5 | 25 | 16 | 32.8 | 21 | 25 | 11.4 |
| 26 | Mon | | 15 | 6 | 32.5 | 12 | 14.1 | 17 | 55.9 | | 4 | 27 | 37.5 | 26 | 18 | 28.8 | 22 | 25 | 18.1 |
| 27 | Tue | | 16 | 6 | 31.9 | 12 | 14.0 | 17 | 56.5 | S | 5 | 29 | 46.7 | 27 | 20 | 56.5 | 23 | 25 | 48.8 |
| 28 | Wed | | 17 | 6 | 31.2 | 12 | 14.0 | 17 | 57.0 | | 6 | - | - | 1 | 23 | 48.8 | 24 | 26 | 37.4 |
| 29 | Thu | | 18 | 6 | 30.5 | 12 | 13.9 | 17 | 57.6 | | 6 | 8 | 18.2 | 2 | 26 | 54.0 | 25 | 27 | 35.2 |
| 30 | Fri | | 19 | 6 | 29.7 | 12 | 13.8 | 17 | 58.1 | S | 7 | 10 | 58.7 | 3 | 29 | 57.4 | 26 | 28 | 31.3 |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

**INDIAN CALENDAR**

Uttarayana
Dakshina Gola

SAKA ERA 1942
Month of MAGHA (30 days)

Ayanamsa on 1st : 24° 08′ 48″

(*Nirayana*) 8 Magha, 5121 Kali Era to (*Nirayana*) 7 Phalguna, 5121 Kali Era

| Date | Gregorian Date | Solar Month | Lunar Month | Transit of the Sun | Phenomena | Festivals |
|---|---|---|---|---|---|---|
| | 2021A.D. | | | | | |
| 1 | Jan. 21 | SAURA MAGHA | CHANDRA PAUSHA | | | 1- Martyrdom Day of Hemu Kalani (Sindhi). |
| 2 | 22 | | | | 2- Sayana Vaidhriti $(30^h 40^m.5)$ | |
| 3 | 23 | | | 3- Enters Sravana nak. $(27^h 59^m.1)$ | | 3- Samba Dasami(Odiaha),Netaji's Birthday. |
| 4 | 24 | | | | | 4- Putrada Ekadasi. |
| 5 | 25 | | | | | |
| 6 | 26 | | | | | 6- Republic Day. |
| 7 | 27 | | | | | |
| 8 | 28 | | | | 8- Full Moon $(24^h 46^m.2)$ | 8- Paushi Purnima, Pusyabhisheka Yatra,Floating Festival/Tai Poosam, Birthday of Lala Lajpat Rai. |
| 9 | 29 | | | | | |
| 10 | 30 | | | | | 10- Martyr's Day (Mahatma Gandhi Commemoration Day ). |
| 11 | 31 | | | | | 11- Ganesha Sankastha Chaturthi. |
| 12 | Feb. 1 | | | | | |
| 13 | 2 | | | | | |
| 14 | 3 | | | | | |
| 15 | 4 | | | | 15- Sayana Vyatipata $(19^h 33^m.4)$ | 15- Birthday of Swami Vivekananda (according to tithi), Astaka (Mamsastaka). |
| 16 | 5 | | | | | |
| 17 | 6 | | | 17- Enters Dhanishtha nak.$(7^h 12^m.1)$ | | |
| 18 | 7 | | | | | 18- Shattila Ekadasi (Smarta). |
| 19 | 8 | | | | | 19-Shattila Ekadasi (Vaishnava and Vidhava). |
| 20 | 9 | | | | | 20- Meru Trayodasi (Jain). |
| 21 | 10 | | | | | 21- Ratanti Kalika Puja. |
| 22 | 11 | | | 22- Saura Phalgunadi $(23^h 54^m.2)$ | 22- New Moon $(24^h 35^m.7)$ | 22- Mauni Amavassya, Tai Amavasya, Makara Vavu(Kerala). |
| 23 | 12 | | CHANDRA MAGHA | | | 23- Magha Sukladi. |
| 24 | 13 | SAURA PHALGUNA | | | 24- Jupiter rises in the West $(10^h 06^m)$ | |
| 25 | 14 | | | | | |
| 26 | 15 | | | | | 26- Varada Chaturthi, Tila Chaturthi, Kunda Chaturti, Ganesh Puja, (Bengal). |
| 27 | 16 | | | | | 27- Sri Panchami, Saraswati Puja, Vasanta Panchami. |
| 28 | 17 | | | | 28- Venus sets in the west $(10^h 10^m)$ | |
| 29 | 18 | | | 29- Enters Trop. Pisces $(16^h 13^m.9)$ | 28- Sayana Vaidhriti $(11^h 10^m.6)$ | 29- Arogya Saptami, Vidhana Saptami. |
| 30 | Feb. 19 | | | 30- Enters Satabhisaj nak. $(11^h 37^m.0)$ | | 30- Shivaji Jayanti, Ratha Saptami (Purvarunodaya). |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Vrisha 2, $25^h 24^m.8$; Mithuna 5, $13^h 02^m.7$; Karkata 7, $21^h 43^m.3$; Simha 9, $27^h 21^m.2$; Kanya 12, $6^h 58^m.5$; Tula 14, $9^h 49^m.7$; Vrischika 16, $12^h 47^m.0$; Dhanus 18, $16^h 14^m.6$; Makara 20, $20^h 30^m.3$; Kumbha 22, $26^h 10^m.6$; Mina 25, $10^h 09^m.1$ Mesha 27, $20^h 56^m.5$; Vrisha 30, $9^h 40^m.6$; Sun enters :- Nirayana Kumbha 23, $21^h 12^m.4$.

# INDIAN CALENDAR

SAKA ERA 1942

Mina : Madhu

Month of PHALGUNA (30 days)

Spring (Vasanta), 1st Month

(*Nirayana*) 8 Phalguna, 5121 Kali Era to (*Nirayana)* 7 Chaitra, 5121 Kali Era

| Date | Week Day | Gregorian Date | | Sunrise | | Apparent Noon | | Sunset | | Tithi No. | | Tithi Ending Moment | | Nakshatra No. | Nakshatra Ending Moment | | Yoga No. | Yoga Ending Moment | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | h | m | h | m | h | m | | | h | m | | h | m | | h | m |
| | | 2021A.D. | | | | | | | | | | | | | | | | | |
| 1 | Sat | Feb. | 20 | 6 | 29.0 | 12 | 13.7 | 17 | 58.7 | S | 8 | 13 | 32.2 | 4 | - | - | 27 | 29 | 14.3 |
| 2 | Sun | | 21 | 6 | 28.3 | 12 | 13.6 | 17 | 59.2 | | 9 | 15 | 42.7 | 4 | 8 | 43.4 | 1 | 29 | 34.0 |
| 3 | Mon | | 22 | 6 | 27.5 | 12 | 13.5 | 17 | 59.7 | S | 10 | 17 | 16.8 | 5 | 10 | 57.8 | 2 | 29 | 22.2 |
| 4 | Tue | | 23 | 6 | 26.7 | 12 | 13.3 | 18 | 00.2 | | 11 | 18 | 05.7 | 6 | 12 | 30.8 | 3 | 28 | 34.2 |
| 5 | Wed | | 24 | 6 | 25.9 | 12 | 13.2 | 18 | 00.7 | | 12 | 18 | 06.0 | 7 | 13 | 17.2 | 4 | 27 | 08.6 |
| 6 | Thu | | 25 | 6 | 25.1 | 12 | 13.0 | 18 | 01.2 | | 13 | 17 | 19.1 | 8 | 13 | 17.2 | 5 | 25 | 07.3 |
| 7 | Fri | | 26 | 6 | 24.3 | 12 | 12.9 | 18 | 01.7 | | 14 | 15 | 50.2 | 9 | 12 | 35.1 | 6 | 22 | 34.7 |
| 8 | Sat | | 27 | 6 | 23.5 | 12 | 12.7 | 18 | 02.1 | S | 15 | 13 | 47.3 | 10 | 11 | 18.2 | 7 | 19 | 36.9 |
| 9 | Sun | | 28 | 6 | 22.6 | 12 | 12.5 | 18 | 02.6 | K | 1 | 11 | 19.4 | 11 | 9 | 35.6 | 8 | 16 | 21.1 |
| 10 | Mon | Mar. | 1 | 6 | 21.8 | 12 | 12.3 | 18 | 03.1 | | 2 | 8 | 36.1 | 12 | 7 | 36.9 | 9 | 12 | 54.7 |
| | | | | | | | | | | | (3 | 29 | 46.7) | (13 | 29 | 31.8) | | | |
| 11 | Tue | | 2 | 6 | 20.9 | 12 | 12.1 | 18 | 03.5 | | 4 | 26 | 59.7 | 14 | 27 | 29.0 | 10 | 9 | 24.9 |
| | | | | | | | | | | | | | | | | | (11 | 29 | 58.1) |
| 12 | Wed | | 3 | 6 | 20.0 | 12 | 11.9 | 18 | 04.0 | K | 5 | 24 | 22.1 | 15 | 25 | 35.7 | 12 | 26 | 39.7 |
| 13 | Thu | | 4 | 6 | 19.2 | 12 | 11.7 | 18 | 04.4 | | 6 | 21 | 59.3 | 16 | 23 | 57.4 | 13 | 23 | 33.9 |
| 14 | Fri | | 5 | 6 | 18.3 | 12 | 11.5 | 18 | 04.9 | | 7 | 19 | 54.9 | 17 | 22 | 37.6 | 14 | 20 | 43.1 |
| 15 | Sat | | 6 | 6 | 17.4 | 12 | 11.2 | 18 | 05.3 | | 8 | 18 | 10.8 | 18 | 21 | 38.0 | 15 | 18 | 08.7 |
| 16 | Sun | | 7 | 6 | 16.5 | 12 | 11.0 | 18 | 05.7 | | 9 | 16 | 47.5 | 19 | 20 | 59.0 | 16 | 15 | 51.0 |
| 17 | Mon | | 8 | 6 | 15.6 | 12 | 10.8 | 18 | 06.2 | K | 10 | 15 | 44.9 | 20 | 20 | 40.3 | 17 | 13 | 49.9 |
| 18 | Tue | | 9 | 6 | 14.6 | 12 | 10.5 | 18 | 06.6 | | 11 | 15 | 02.6 | 21 | 20 | 41.4 | 18 | 12 | 04.9 |
| 19 | Wed | | 10 | 6 | 13.7 | 12 | 10.3 | 18 | 07.0 | | 12 | 14 | 40.7 | 22 | 21 | 02.7 | 19 | 10 | 35.9 |
| 20 | Thu | | 11 | 6 | 12.8 | 12 | 10.0 | 18 | 07.4 | | 13 | 14 | 40.3 | 23 | 21 | 45.3 | 20 | 9 | 23.6 |
| 21 | Fri | | 12 | 6 | 11.8 | 12 | 09.7 | 18 | 07.8 | | 14 | 15 | 03.0 | 24 | 22 | 51.0 | 21 | 8 | 29.1 |
| 22 | Sat | | 13 | 6 | 10.9 | 12 | 09.5 | 18 | 08.2 | K | 30 | 15 | 51.2 | 25 | 24 | 21.9 | 22 | 7 | 53.7 |
| 23 | Sun | | 14 | 6 | 09.9 | 12 | 09.2 | 18 | 08.6 | S | 1 | 17 | 06.7 | 26 | 26 | 19.5 | 23 | 7 | 39.1 |
| 24 | Mon | | 15 | 6 | 09.0 | 12 | 08.9 | 18 | 09.0 | | 2 | 18 | 50.0 | 27 | 28 | 43.5 | 24 | 7 | 45.7 |
| 25 | Tue | | 16 | 6 | 08.0 | 12 | 08.6 | 18 | 09.4 | | 3 | 20 | 59.4 | 1 | - | - | 25 | 8 | 13.1 |
| 26 | Wed | | 17 | 6 | 07.1 | 12 | 08.3 | 18 | 09.8 | | 4 | 23 | 29.2 | 1 | 7 | 30.8 | 26 | 8 | 58.3 |
| 27 | Thu | | 18 | 6 | 06.1 | 12 | 08.1 | 18 | 10.2 | S | 5 | 26 | 10.0 | 2 | 10 | 34.5 | 27 | 9 | 56.2 |
| 28 | Fri | | 19 | 6 | 05.1 | 12 | 07.8 | 18 | 10.6 | | 6 | 28 | 48.7 | 3 | 13 | 44.0 | 1 | 10 | 58.8 |
| 29 | Sat | | 20 | 6 | 04.1 | 12 | 07.5 | 18 | 10.9 | | 7 | - | - | 4 | 16 | 45.5 | 2 | 11 | 56.6 |
| 30 | Sun | | 21 | 6 | 03.2 | 12 | 07.2 | 18 | 11.3 | S | 7 | 7 | 10.5 | 5 | 19 | 24.5 | 3 | 12 | 38.7 |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

Uttarayana
Dakshina Gola

SAKA ERA 1942
Month of PHALGUNA (30 days)

Ayanamsa on 1st : 24°08′53″

(*Nirayana*) 8 Phalguna, 5121 Kali Era to (*Nirayana*) 7 Chaitra, 5121 Kali Era

| Date | Gregorian Date | Solar Month | Lunar Month | Transit of the Sun | Phenomena | Festivals |
|---|---|---|---|---|---|---|
| | 2021 A.D. | | | | | |
| 1 | Feb. 20 | SAURA PHALGUNA | CHANDRA MAGHA | | | 1- Bhishmashtami. |
| 2 | 21 | | | | | |
| 3 | 22 | | | | | |
| 4 | 23 | | | | | 4- Jaya Ekadasi, Bhaimi Ekadasi (Bengal) |
| 5 | 24 | | | | | 5- Bhishma Dvadasi. |
| 6 | 25 | | | | | 6- Desert Festival - 3 days (Jaislmer) |
| 7 | 26 | | | | | |
| 8 | 27 | | | | 8- Full Moon ($13^h 47^m.3$) | 8- Guru Rabi Das's Birthday. (according to tithi), Maghi Purnima, Masi Magham. |
| 9 | 28 | | | | | |
| 10 | Mar. 1 | | | | | |
| 11 | 2 | | | | 11- Sayana Vyatipata ($6^h 54^m.5$) | |
| 12 | 3 | | | | | |
| 13 | 4 | | | 13-Enters Purva Bhadrapada nak. ($17^h 59^m.7$) | | |
| 14 | 5 | | | | | 14- Vaikkatashtami (kerela). |
| 15 | 6 | | | | | 15- Ashtaka (Sakashtal, Janaki Janma. |
| 16 | 7 | | | | | |
| 17 | 8 | | | | | 17- Birthday of Swami Dayananda Saraswati (Founder of Arya Samaj). |
| 18 | 9 | | | | | 18. Vijaya Ekadasi. |
| 19 | 10 | | | | | 19- Maha Sivratri (Kashmir).. |
| 20 | 11 | | | | | 20- Maha Sivratri, Maha Sivratri (S. India). |
| 21 | 12 | | | | | |
| 22 | 13 | | | 22-Saura Chaitradi ($20^h 26^m.0$) | 22- New Moon ($15^h 51^m.2$) | |
| 23 | 14 | | CHANDRA PHALGUNA | | 23- Sayana Vaidhriti ($16^h 45^m.5$) | |
| 24 | 15 | SAURA CHAITRA | | | | 24- Birthday of Sri Ramakrisha (according to tithi). |
| 25 | 16 | | | | | |
| 26 | 17 | | | 26-Enters Uttara Bhadrapada nak. ($26^h 21^m.6$) | | |
| 27 | 18 | | | | | |
| 28 | 19 | | | | | |
| 29 | 20 | | | 29-Enters Trop. Aries($15^h 07^m.4$) | | 29- Mahavishuva day. |
| 30 | Mar. 21 | | | | | 30- Indian Year Ending day, Holastaka. |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½°E. Long.

Moon enters :-Mithuna 2,$21^h 55^m.3$;Karkata 5,$7^h 10^m.1$;Simha 7,$12^h 35^m.1$;Kanya 9,$15^h 07^m.0$;Tula 11,$16^h 29^m.7$; Vrischika 13, $18^h 20^m.4$; Dhanus 15, $21^h 38^m.0$;Makara 17, $26^h 38^m.7$; Kumbha 20, $9^h 21^m.2$;Mina 22, $17^h 56^m.7$;Mesha 24, $28^h 43^m.5$; Vrisha 27,$17^h 21^m.9$; Mithuna 30,$6^h 08^m.7$; Sun enters: Nirayana Mina 23, $18^h 03^m.6$.

# INDIAN CALENDAR

SAKA ERA 1943 — Mesha : Madhava

Month of CHAITRA (30 days) — Spring (Vasanta), 2nd Month

(*Nirayana*) 8 Chaitra, 5121 Kali Era to (*Nirayana*) 7 Vaisakha, 5122 Kali Era

| Date | Week Day | Gregorian Date | Sunrise | | Apparent Noon | | Sunset | | Tithi | | | Nakshatra | | | Yoga | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | No. | Ending Moment | | No. | Ending Moment | | No. | Ending Moment | |
| | | | h | m | h | m | h | m | | h | m | | h | m | | h | m |
| | | 2021 A.D. | | | | | | | | | | | | | | | |
| 1 | Mon | Mar. 22 | 6 | 02.2 | 12 | 06.9 | 18 | 11.7 | S 8 | 9 | 00.7 | 6 | 21 | 27.7 | 4 | 12 | 55.0 |
| 2 | Tue | 23 | 6 | 01.2 | 12 | 06.6 | 18 | 12.1 | 9 | 10 | 07.6 | 7 | 22 | 45.2 | 5 | 12 | 37.4 |
| 3 | Wed | 24 | 6 | 00.3 | 12 | 06.3 | 18 | 12.5 | S 10 | 10 | 23.9 | 8 | 23 | 12.2 | 6 | 11 | 40.5 |
| 4 | Thu | 25 | 5 | 59.3 | 12 | 06.0 | 18 | 12.8 | 11 | 9 | 47.7 | 9 | 22 | 48.7 | 7 | 10 | 02.6 |
| 5 | Fri | 26 | 5 | 58.3 | 12 | 05.7 | 18 | 13.2 | 12 | 8 | 21.6 | 10 | 21 | 39.2 | 8 | 7 | 45.2 |
| | | | | | | | | | | | | | | | (9 | 28 | 52.5) |
| 6 | Sat | 27 | 5 | 57.3 | 12 | 05.4 | 18 | 13.6 | 13 | 6 | 12.0 | 11 | 19 | 51.6 | 10 | 25 | 31.1 |
| | | | | | | | | | (14 | 27 | 27.4) | | | | | | |
| 7 | Sun | 28 | 5 | 56.4 | 12 | 05.1 | 18 | 14.0 | S 15 | 24 | 18.1 | 12 | 17 | 35.6 | 11 | 21 | 48.5 |
| 8 | Mon | 29 | 5 | 55.4 | 12 | 04.8 | 18 | 14.3 | K 1 | 20 | 54.8 | 13 | 15 | 02.0 | 12 | 17 | 53.4 |
| 9 | Tue | 30 | 5 | 54.4 | 12 | 04.5 | 18 | 14.7 | 2 | 17 | 27.7 | 14 | 12 | 21.7 | 13 | 13 | 53.9 |
| 10 | Wed | 31 | 5 | 53.5 | 12 | 04.2 | 18 | 15.1 | 3 | 14 | 06.6 | 15 | 9 | 45.2 | 14 | 9 | 58.2 |
| 11 | Thu | Apr. 1 | 5 | 52.5 | 12 | 03.9 | 18 | 15.4 | 4 | 11 | 00.3 | 16 | 7 | 21.7 | 15 | 6 | 13.4 |
| | | | | | | | | | | | | (17 | 29 | 19.2) | (16 | 26 | 45.6) |
| 12 | Fri | 2 | 5 | 51.5 | 12 | 03.6 | 18 | 15.8 | K 5 | 8 | 15.9 | 18 | 27 | 43.6 | 17 | 23 | 39.4 |
| 13 | Sat | 3 | 5 | 50.6 | 12 | 03.3 | 18 | 16.2 | 6 | 5 | 59.0 | 19 | 26 | 38.5 | 18 | 20 | 57.8 |
| | | | | | | | | | (7 | 28 | 13.2) | | | | | | |
| 14 | Sun | 4 | 5 | 49.6 | 12 | 03.0 | 18 | 16.5 | 8 | 27 | 00.0 | 20 | 26 | 05.6 | 19 | 18 | 42.3 |
| 15 | Mon | 5 | 5 | 48.7 | 12 | 02.7 | 18 | 16.9 | 9 | 26 | 19.3 | 21 | 26 | 04.8 | 20 | 16 | 53.0 |
| 16 | Tue | 6 | 5 | 47.7 | 12 | 02.4 | 18 | 17.3 | K 10 | 26 | 09.7 | 22 | 26 | 34.6 | 21 | 15 | 29.0 |
| 17 | Wed | 7 | 5 | 46.8 | 12 | 02.1 | 18 | 17.7 | 11 | 26 | 29.4 | 23 | 27 | 32.9 | 22 | 14 | 28.7 |
| 18 | Thu | 8 | 5 | 45.8 | 12 | 01.8 | 18 | 18.1 | 12 | 27 | 16.2 | 24 | 28 | 57.4 | 23 | 13 | 50.4 |
| 19 | Fri | 9 | 5 | 44.9 | 12 | 01.6 | 18 | 18.4 | 13 | 28 | 28.2 | 25 | - | - | 24 | 13 | 32.5 |
| 20 | Sat | 10 | 5 | 44.0 | 12 | 01.3 | 18 | 18.8 | 14 | - | - | 25 | 6 | 46.1 | 25 | 13 | 33.5 |
| 21 | Sun | 11 | 5 | 43.1 | 12 | 01.0 | 18 | 19.2 | 14 | 6 | 03.7 | 26 | 8 | 57.5 | 26 | 13 | 52.1 |
| 22 | Mon | 12 | 5 | 42.2 | 12 | 00.8 | 18 | 19.6 | K 30 | 8 | 00.8 | 27 | 11 | 29.4 | 27 | 14 | 26.7 |
| 23 | Tue | 13 | 5 | 41.3 | 12 | 00.5 | 18 | 20.0 | S 1 | 10 | 17.1 | 1 | 14 | 19.3 | 1 | 15 | 15.2 |
| 24 | Wed | 14 | 5 | 40.4 | 12 | 00.3 | 18 | 20.4 | 2 | 12 | 48.2 | 2 | 17 | 22.5 | 2 | 16 | 14.3 |
| 25 | Thu | 15 | 5 | 39.5 | 12 | 00.0 | 18 | 20.8 | 3 | 15 | 27.5 | 3 | 20 | 32.5 | 3 | 17 | 18.9 |
| 26 | Fri | 16 | 5 | 38.6 | 11 | 59.8 | 18 | 21.2 | 4 | 18 | 06.2 | 4 | 23 | 39.9 | 4 | 18 | 22.7 |
| 27 | Sat | 17 | 5 | 37.8 | 11 | 59.6 | 18 | 21.6 | S 5 | 20 | 32.9 | 5 | 26 | 33.5 | 5 | 19 | 17.5 |
| 28 | Sun | 18 | 5 | 36.9 | 11 | 59.4 | 18 | 22.0 | 6 | 22 | 35.3 | 6 | 29 | 01.5 | 6 | 19 | 54.5 |
| 29 | Mon | 19 | 5 | 36.1 | 11 | 59.1 | 18 | 22.4 | 7 | 24 | 02.0 | 7 | - | - | 7 | 20 | 05.4 |
| 30 | Tue | 20 | 5 | 35.3 | 11 | 58.9 | 18 | 22.8 | S 8 | 24 | 43.8 | 7 | 6 | 52.6 | 8 | 19 | 42.7 |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

# INDIAN CALENDAR

Uttarayana
Uttara Gola

SAKA ERA 1943
Month of CHAITRA (30 days)

Ayanamsa on 1st : $24^{0}08^{/}56^{//}$

(*Nirayana*) 8 Chaitra, 5121 Kali Era to (*Nirayana)* 7 Vaisakha, 5122 Kali Era

| Date | Gregorian Date | Solar Month | Lunar Month | Transit of the Sun | Phenomena | Festivals |
|---|---|---|---|---|---|---|
| | 2021 A.D | | | | | |
| 1 | Mar. 22 | SAURA CHAITRA | CHANDRA PHALGUNA | | | 1- Indian New Year's Day. |
| 2 | 23 | | | | | |
| 3 | 24 | | | | | |
| 4 | 25 | | | | | 4- Amlaki Ekadasi. |
| 5 | 26 | | | | | |
| 6 | 27 | | | | 6- Sayana Vyatipata ($22^h 57^m.6$) | |
| 7 | 28 | | | | 7- Full Moon ($24^h 18^m.1$) | 7-Holikadahan, Birthday of Sri Chaitanya, Dol Yatra, Panguni Uttiram. |
| 8 | 29 | | | | | 8- Vasantotsava, Holi, Trivandrum Arat(Kerala),Hola. |
| 9 | 30 | | | | | |
| 10 | 31 | | | 10- Enters Revati nak. ($13^h 14^m.9$) | | |
| 11 | Apr. 1 | | | | | |
| 12 | 2 | | | | | 12- Ranga Panchami, Bijoy Gobinda-Ji Halangkar(Manipur). |
| 13 | 3 | | | | | |
| 14 | 4 | | | | | 14- Varsitaparambha (Jain), Sitashtami. |
| 15 | 5 | | | | 15 -Jupiter enters Kumbha ($24^h 24^m.0$) | 15- Birthday Anniversary of Swami Leela Shah (Sindhi). |
| 16 | 6 | | | | | |
| 17 | 7 | | | | | 17- Papamochani Ekadasi. |
| 18 | 8 | | | | 18 -Sayana Vaidhriti ($22^h 47^m.1$) | |
| 19 | 9 | | | | | 19- Madhukrishna Trayodasi. |
| 20 | 10 | | | | | |
| 21 | 11 | | | | | |
| 22 | 12 | | | 22- Saura Vaisakhadi ($28^h 31^m.6$) | 22-New Moon ($8^h 01^m.0$) | |
| 23 | 13 | | CHANDRA CHAITRA | 23-Sun Enters Asvini Nak. ($26^h 32^m.8$) | | 23- Visu(Kerala), Vaisakhi(Punjab, H.P, Haryana, Delhi & Odisha), Cheti Chand(Sindhi New Year's Day), Chaitra Sukladi (Gudi padava, Ugadi), Telugu New Year,s Day, Vasant Navaratrarambha. |
| 24 | 14 | SAURA VAISAKHA | | | | 24- Chaitra Samkranti, Chadak Puja, Mesha Samkranti, Cheiraoba (Manipur), Meshadi(T.N.), Tamil New Years Day, Maha Kumbha at Hardwar, Dr. B.R. Ambedkar Jayanti, Beginning of 5122 Kali Era. |
| 25 | 15 | | | | | 25- Gauri Tritiya(Gangaur), Andolana Tritiya, Sarhul(Bihar), Vaisakhadi (Bengal), Bahag Bihu(Assam), Shilhenba (Manipur). |
| 26 | 16 | | | | | |
| 27 | 17 | | | | | 27- Sri Lashmi Panchami. |
| 28 | 18 | | | | | 28- Skanda Shashthi, Sri Ramanujacharya Jayanti(S. India). |
| 29 | 19 | | | 29- Enters Tropical Taurus ($26^h 03^m.4$m) | 29- Venus rises in the West ($05^h 41^m.0$) | 29- Oli begins (Jain), Vasanti Pujarambha. |
| 30 | Apr. 20 | | | | | 30- Annapurna puja, Ashokashtami (Punarvasu upto $6^h 53^m.0$), Mela Bahu Fort(Jammu). |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Karkata 2, $16^h 30^m.4$; Simha 4, $22^h 48^m.7$; Kanya 6, $25^h 19^m.9$; Tula 8, $25^h 42^m.0$; Vrischika 10, $25^h 55^m.9$; Dhanus 12, $27^h 43^m.6$; Makara 15, $8^h 02^m.4$; Kumbha 17, $15^h 00^m.3$; Mina 19, $24^h 16^m.8$; Mesha 22, $11^h 29^m.4$; Vrisha 24, $24^h 09^m.7$; Mithuna 27, $13^h 09^m.2$; Karkata 29, $24^h 28^m.8$;

Sun enters :- Nirayana Mesha 23, $26^h 32^m.8$m.

**INDIAN CALENDAR**

SAKA ERA 1943

Vrisha : Sukra

Month of VAISAKHA (31 days)

Summer (Grishma), 1st Month

(*Nirayana*) 8 Vaisakha, 5122 Kali Era to (*Nirayana*) 7 Jyaishtha, 5122 Kali Era

| Date | Week Day | Gregorian Date | | Sunrise | | Apparent Noon | | Sunset | | Tithi No. | | Tithi Ending Moment | | Nakshatra No. | Nakshatra Ending Moment | | Yoga No. | Yoga Ending Moment | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | h | m | h | m | h | m | | | h | m | | h | m | | h | m |
| | | 2021 A.D. | | | | | | | | | | | | | | | | | |
| 1 | Wed | Apr. | 21 | 5 | 34.4 | 11 | 58.7 | 18 | 23.2 | S | 9 | 24 | 35.5 | 8 | 7 | 58.7 | 9 | 18 | 41.7 |
| 2 | Thu | | 22 | 5 | 33.6 | 11 | 58.5 | 18 | 23.6 | S | 10 | 23 | 35.9 | 9 | 8 | 15.0 | 10 | 17 | 00.1 |
| 3 | Fri | | 23 | 5 | 32.8 | 11 | 58.3 | 18 | 24.1 | | 11 | 21 | 47.9 | 10 | 7 | 41.6 | 11 | 14 | 38.9 |
| 4 | Sat | | 24 | 5 | 32.0 | 11 | 58.1 | 18 | 24.5 | | 12 | 19 | 17.6 | 11 | 6 | 22.1 | 12 | 11 | 41.5 |
| | | | | | | | | | | | | | | (12 | 28 | 23.4) | | | |
| 5 | Sun | | 25 | 5 | 31.3 | 11 | 58.0 | 18 | 24.9 | | 13 | 16 | 13.3 | 13 | 25 | 54.5 | 13 | 8 | 13.6 |
| | | | | | | | | | | | | | | | | | (14 | 28 | 22.2) |
| 6 | Mon | | 26 | 5 | 30.5 | 11 | 57.8 | 18 | 25.3 | | 14 | 12 | 44.5 | 14 | 23 | 05.8 | 15 | 24 | 15.5 |
| 7 | Tue | | 27 | 5 | 29.8 | 11 | 57.6 | 18 | 25.8 | S | 15 | 9 | 01.6 | 15 | 20 | 08.3 | 16 | 20 | 02.0 |
| | | | | | | | | | | (K | 1 | 29 | 14.8) | | | | | | |
| 8 | Wed | | 28 | 5 | 29.0 | 11 | 57.5 | 18 | 26.2 | | 2 | 25 | 34.6 | 16 | 17 | 12.7 | 17 | 15 | 50.1 |
| 9 | Thu | | 29 | 5 | 28.3 | 11 | 57.4 | 18 | 26.6 | | 3 | 22 | 10.2 | 17 | 14 | 29.4 | 18 | 11 | 47.9 |
| 10 | Fri | | 30 | 5 | 27.6 | 11 | 57.2 | 18 | 27.1 | | 4 | 19 | 10.3 | 18 | 12 | 07.7 | 19 | 8 | 02.6 |
| | | | | | | | | | | | | | | | | | (20 | 28 | 40.7) |
| 11 | Sat | May | 1 | 5 | 26.9 | 11 | 57.1 | 18 | 27.5 | K | 5 | 16 | 41.9 | 19 | 10 | 15.5 | 21 | 25 | 47.1 |
| 12 | Sun | | 2 | 5 | 26.2 | 11 | 57.0 | 18 | 28.0 | | 6 | 14 | 50.6 | 20 | 8 | 58.9 | 22 | 23 | 25.1 |
| 13 | Mon | | 3 | 5 | 25.6 | 11 | 56.9 | 18 | 28.4 | | 7 | 13 | 39.8 | 21 | 8 | 22.0 | 23 | 21 | 36.3 |
| 14 | Tue | | 4 | 5 | 24.9 | 11 | 56.8 | 18 | 28.9 | | 8 | 13 | 10.7 | 22 | 8 | 26.2 | 24 | 20 | 20.6 |
| 15 | Wed | | 5 | 5 | 24.3 | 11 | 56.7 | 18 | 29.3 | | 9 | 13 | 22.2 | 23 | 9 | 10.6 | 25 | 19 | 36.4 |
| 16 | Thu | | 6 | 5 | 23.7 | 11 | 56.6 | 18 | 29.8 | K | 10 | 14 | 11.0 | 24 | 10 | 32.1 | 26 | 19 | 20.6 |
| 17 | Fri | | 7 | 5 | 23.1 | 11 | 56.5 | 18 | 30.2 | | 11 | 15 | 32.5 | 25 | 12 | 26.0 | 27 | 19 | 29.2 |
| 18 | Sat | | 8 | 5 | 22.5 | 11 | 56.5 | 18 | 30.7 | | 12 | 17 | 21.2 | 26 | 14 | 46.8 | 1 | 19 | 58.0 |
| 19 | Sun | | 9 | 5 | 21.9 | 11 | 56.4 | 18 | 31.2 | | 13 | 19 | 31.0 | 27 | 17 | 28.6 | 2 | 20 | 42.6 |
| 20 | Mon | | 10 | 5 | 21.4 | 11 | 56.4 | 18 | 31.7 | | 14 | 21 | 55.9 | 1 | 20 | 25.3 | 3 | 21 | 38.5 |
| 21 | Tue | | 11 | 5 | 20.9 | 11 | 56.4 | 18 | 32.1 | K | 30 | 24 | 29.8 | 2 | 23 | 31.2 | 4 | 22 | 41.4 |
| 22 | Wed | | 12 | 5 | 20.4 | 11 | 56.4 | 18 | 32.6 | S | 1 | 27 | 06.5 | 3 | 26 | 39.9 | 5 | 23 | 46.8 |
| 23 | Thu | | 13 | 5 | 19.9 | 11 | 56.3 | 18 | 33.1 | | 2 | - | - | 4 | - | - | 6 | 24 | 49.9 |
| 24 | Fri | | 14 | 5 | 19.4 | 11 | 56.3 | 18 | 33.5 | | 2 | 5 | 39.1 | 4 | 5 | 44.9 | 7 | 25 | 45.5 |
| 25 | Sat | | 15 | 5 | 18.9 | 11 | 56.4 | 18 | 34.0 | | 3 | 8 | 00.1 | 5 | 8 | 38.9 | 8 | 26 | 27.7 |
| 26 | Sun | | 16 | 5 | 18.5 | 11 | 56.4 | 18 | 34.5 | | 4 | 10 | 01.5 | 6 | 11 | 13.9 | 9 | 26 | 50.6 |
| 27 | Mon | | 17 | 5 | 18.1 | 11 | 56.4 | 18 | 35.0 | S | 5 | 11 | 35.1 | 7 | 13 | 21.7 | 10 | 26 | 48.2 |
| 28 | Tue | | 18 | 5 | 17.7 | 11 | 56.4 | 18 | 35.4 | | 6 | 12 | 33.3 | 8 | 14 | 55.1 | 11 | 26 | 15.6 |
| 29 | Wed | | 19 | 5 | 17.3 | 11 | 56.5 | 18 | 35.9 | | 7 | 12 | 50.5 | 9 | 15 | 48.1 | 12 | 25 | 09.0 |
| 30 | Thu | | 20 | 5 | 16.9 | 11 | 56.5 | 18 | 36.4 | | 8 | 12 | 23.3 | 10 | 15 | 57.3 | 13 | 23 | 26.5 |
| 31 | Fri | | 21 | 5 | 16.6 | 11 | 56.6 | 18 | 36.9 | S | 9 | 11 | 11.1 | 11 | 15 | 22.3 | 14 | 21 | 08.4 |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

Uttarayana
Uttara Gola

SAKA ERA 1943
Month of VAISAKHA (31 days)

Ayanamsa on 1st : $24^{0}09'00''$

(*Nirayana*) 8 Vaisakha, 5122 Kali Era to (*Nirayana*) 7 Jyaishtha, 5122 Kali Era

| Date | Gregorian Date | Solar Month | Lunar Month | Transit of the Sun | Phenomena | Festivals |
|---|---|---|---|---|---|---|
| | 2021A.D. | | | | | |
| 1 | Apr. 21 | SAURA VAISAKHA | CHANDRA CHAITRA | | | 1- Rama Navami. |
| 2 | 22 | | | | 2- Sayana Vyatipata ($14^h 13^m.3$) | |
| 3 | 23 | | | | | 3 - Babu Kuer Singh Day (Bihar), Kamada Ekadasi, Trichur Pooram (Kerala). |
| 4 | 24 | | | | | 4 - Minakshi Kalyanam. |
| 5 | 25 | | | | | 5 - Ananga Trayodasi,Mahavira Jayanti (Jain), Damanaka Chaturdasi. |
| 6 | 26 | | | | | |
| 7 | 27 | | | 7- Enters Bharani nak. ($18^h 23^m.8$) | 7- Full Moon ($9^h 01^m.6$) | 7 - Chaitri Purnima, Hanumat Jayanti (S.India), Oli Ends(Jain). |
| 8 | 28 | | | | | |
| 9 | 29 | | | | | |
| 10 | 30 | | | | | |
| 11 | May 1 | | | | | 11- May Day. |
| 12 | 2 | | | | | |
| 13 | 3 | | | | | 13- Birthday Anniversary of Dada Chellaram (Sindhi). |
| 14 | 4 | | | | 14- Sayana Vaidhriti ($6^h 07^m.6$) | |
| 15 | 5 | | | | | |
| 16 | 6 | | | | | |
| 17 | 7 | | | | | 17- Sri Vallabhacharya Jayanti, Varuthini Ekadasi. |
| 18 | 8 | | | | | |
| 19 | 9 | | | | | 19-Birthday of Rabindranath Tagore. |
| 20 | 10 | | | | | |
| 21 | 11 | | | 21- Enters Krittika nak.($12^h 34^m.1$) | 21- New Moon ($24^h 29^m.8$) | |
| 22 | 12 | | CHANDRA VAISAKHA | | | 22 - Tithi of Deva Damodora(Assam). |
| 23 | 13 | | | 23- Saura Jyaishthadi ($25^h 01^m.1$) | | |
| 24 | 14 | | | | | 24 - Parasuram Jayanti, Akshya Tritiya, Maha Kumbha Ends, Kedar Badri Yatra. |
| 25 | 15 | SAURA JYAISHTHA | | | | 25- Varsitapa Samapanna, Akshya Tritiya (Bengal). |
| 26 | 16 | | | | | |
| 27 | 17 | | | | 27- Sayana Vyatipata ($23^h 50^m.0$) | 27- Sri Sankaracharya Jayanti. |
| 28 | 18 | | | | | 28- Sri Ramanujacharya Jayanti, |
| 29 | 19 | | | | | 29- Gangotpatti. |
| 30 | 20 | | | 30- Sun Enters Trop.Gemini ($25^h 07^m.1$) | | |
| 31 | May 21 | | | | | 31- Sita Navami. |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Simha 2, $8^h 15^m.0$; Kanya 4, $11^h 55^m.7$; Tula 6, $12^h 31^m.9$; Vrischika 8, $11^h 55^m.8$; Dhanus 10, $12^h 07^m.6$; Makara 12, $14^h 45^m.9$; Kumbha 14, $20^h 43^m.6$; Mina 17, $5^h 54^m.8$; Mesha 19, $17^h 28^m.6$; Vrisha 22, $6^h 18^m.3$; Mithuna 24, $19^h 13^m.8$; Karkata 27, $06^h 52^m.7$; Simha 29, $15^h 48^m.0$; Kanya 31, $21^h 06^m.8$; Sun enters :-Nirayana Vrisha 24, $23^h 25^m.1$

SAKA ERA 1943

Month of JYAISHTHA (31 days)

Mithuna :Suchi

Summer (Grishma), 2nd Month

(*Nirayana*) 8 Jyaishtha, 5122 Kali Era to (*Nirayana)* 7 Ashadha, 5122 Kali Era

| Date | Week Day | Gregorian Date | Sunrise h | Sunrise m | Apparent Noon h | Apparent Noon m | Sunset h | Sunset m | Tithi No. | Tithi Ending Moment h | Tithi Ending Moment m | Nakshatra No. | Nakshatra Ending Moment h | Nakshatra Ending Moment m | Yoga No. | Yoga Ending Moment h | Yoga Ending Moment m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2021 A.D. | | | | | | | | | | | | | | | |
| 1 | Sat | May 22 | 5 | 16.3 | 11 | 56.7 | 18 | 37.3 | S 10 | 9 | 16.1 | 12 | 14 | 05.5 | 15 | 18 | 17.0 |
| 2 | Sun | 23 | 5 | 16.0 | 11 | 56.8 | 18 | 37.8 | 11 | 6 | 43.2 | 13 | 12 | 12.1 | 16 | 14 | 56.4 |
| | | | | | | | | | (12 | 27 | 39.0) | | | | | | |
| 3 | Mon | 24 | 5 | 15.7 | 11 | 56.8 | 18 | 38.3 | 13 | 24 | 11.6 | 14 | 9 | 49.3 | 17 | 11 | 12.4 |
| 4 | Tue | 25 | 5 | 15.4 | 11 | 56.9 | 18 | 38.7 | 14 | 20 | 30.0 | 15 | 7 | 05.7 | 18 | 7 | 11.7 |
| | | | | | | | | | | | | (16 | 28 | 11.0) | (19 | 27 | 01.8) |
| 5 | Wed | 26 | 5 | 15.2 | 11 | 57.0 | 18 | 39.2 | S 15 | 16 | 43.9 | 17 | 25 | 15.4 | 20 | 22 | 50.8 |
| 6 | Thu | 27 | 5 | 14.9 | 11 | 57.2 | 18 | 39.6 | K 1 | 13 | 02.9 | 18 | 22 | 29.2 | 21 | 18 | 46.5 |
| 7 | Fri | 28 | 5 | 14.7 | 11 | 57.3 | 18 | 40.1 | 2 | 9 | 36.5 | 19 | 20 | 02.3 | 22 | 14 | 56.9 |
| 8 | Sat | 29 | 5 | 14.5 | 11 | 57.4 | 18 | 40.5 | 3 | 6 | 34.0 | 20 | 18 | 03.7 | 23 | 11 | 29.1 |
| | | | | | | | | | (4 | 28 | 03.9) | | | | | | |
| 9 | Sun | 30 | 5 | 14.3 | 11 | 57.5 | 18 | 41.0 | K 5 | 26 | 13.0 | 21 | 16 | 41.5 | 24 | 8 | 29.5 |
| 10 | Mon | 31 | 5 | 14.2 | 11 | 57.7 | 18 | 41.4 | 6 | 25 | 06.4 | 22 | 16 | 01.6 | 25 | 6 | 03.1 |
| | | | | | | | | | | | | | | | (26 | 28 | 13.3) |
| 11 | Tue | June 1 | 5 | 14.1 | 11 | 57.8 | 18 | 41.8 | 7 | 24 | 46.7 | 23 | 16 | 07.5 | 27 | 27 | 01.1 |
| 12 | Wed | 2 | 5 | 13.9 | 11 | 58.0 | 18 | 42.2 | 8 | 25 | 13.4 | 24 | 16 | 59.5 | 1 | 26 | 25.5 |
| 13 | Thu | 3 | 5 | 13.9 | 11 | 58.2 | 18 | 42.7 | 9 | 26 | 22.7 | 25 | 18 | 34.7 | 2 | 26 | 22.9 |
| 14 | Fri | 4 | 5 | 13.8 | 11 | 58.3 | 18 | 43.1 | K 10 | 28 | 07.9 | 26 | 20 | 46.9 | 3 | 26 | 48.1 |
| 15 | Sat | 5 | 5 | 13.7 | 11 | 58.5 | 18 | 43.5 | 11 | --- | --- | 27 | 23 | 27.7 | 4 | 27 | 34.3 |
| 16 | Sun | 6 | 5 | 13.7 | 11 | 58.7 | 18 | 43.9 | 11 | 6 | 19.9 | 1 | 26 | 27.2 | 5 | 28 | 34.2 |
| 17 | Mon | 7 | 5 | 13.7 | 11 | 58.9 | 18 | 44.3 | 12 | 8 | 48.8 | 2 | --- | --- | 6 | --- | --- |
| 18 | Tue | 8 | 5 | 13.7 | 11 | 59.1 | 18 | 44.6 | 13 | 11 | 24.7 | 2 | 5 | 35.7 | 6 | 5 | 40.6 |
| 19 | Wed | 9 | 5 | 13.7 | 11 | 59.3 | 18 | 45.0 | 14 | 13 | 58.5 | 3 | 8 | 44.0 | 7 | 6 | 46.9 |
| 20 | Thu | 10 | 5 | 13.7 | 11 | 59.5 | 18 | 45.4 | K 30 | 16 | 22.6 | 4 | 11 | 44.4 | 8 | 7 | 47.3 |
| 21 | Fri | 11 | 5 | 13.8 | 11 | 59.7 | 18 | 45.7 | S 1 | 18 | 30.9 | 5 | 14 | 30.6 | 9 | 8 | 37.1 |
| 22 | Sat | 12 | 5 | 13.8 | 11 | 59.9 | 18 | 46.0 | 2 | 20 | 18.4 | 6 | 16 | 57.4 | 10 | 9 | 12.4 |
| 23 | Sun | 13 | 5 | 13.9 | 12 | 00.1 | 18 | 46.4 | 3 | 21 | 40.8 | 7 | 19 | 00.6 | 11 | 9 | 29.9 |
| 24 | Mon | 14 | 5 | 14.0 | 12 | 00.3 | 18 | 46.7 | 4 | 22 | 34.7 | 8 | 20 | 36.5 | 12 | 9 | 26.5 |
| 25 | Tue | 15 | 5 | 14.2 | 12 | 00.5 | 18 | 47.0 | S 5 | 22 | 57.2 | 9 | 21 | 42.0 | 13 | 8 | 59.8 |
| 26 | Wed | 16 | 5 | 14.3 | 12 | 00.7 | 18 | 47.3 | 6 | 22 | 46.1 | 10 | 22 | 14.7 | 14 | 8 | 07.7 |
| 27 | Thu | 17 | 5 | 14.4 | 12 | 00.9 | 18 | 47.5 | 7 | 22 | 00.3 | 11 | 22 | 13.1 | 15 | 6 | 48.4 |
| | | | | | | | | | | | | | | | (16 | 29 | 01.2) |
| 28 | Fri | 18 | 5 | 14.6 | 12 | 01.2 | 18 | 47.8 | 8 | 20 | 39.7 | 12 | 21 | 37.2 | 17 | 26 | 46.1 |
| 29 | Sat | 19 | 5 | 14.8 | 12 | 01.4 | 18 | 48.0 | 9 | 18 | 45.8 | 13 | 20 | 28.3 | 18 | 24 | 04.4 |
| 30 | Sun | 20 | 5 | 15.0 | 12 | 01.6 | 18 | 48.3 | S 10 | 16 | 21.7 | 14 | 18 | 49.4 | 19 | 20 | 58.6 |
| 31 | Mon | 21 | 5 | 15.2 | 12 | 01.8 | 18 | 48.5 | S 11 | 13 | 31.9 | 15 | 16 | 45.4 | 20 | 17 | 32.5 |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

Uttarayana — SAKA ERA 1943

Uttara Gola — Month of JYAISHTHA (31 days) — Ayanamsa on 1st : $24^{0} 09^{\prime} 04^{\prime\prime}$

*(Nirayana)* 8 Jyaishtha, 5122 Kali Era to *(Nirayana)* 7 Ashadha, 5122 Kali Era

| Date | Gregorian Date | Solar Month | Lunar Month | Transit of the Sun | Phenomena | Festivals |
|---|---|---|---|---|---|---|
| | 2021 A.D. | | | | | |
| 1 | May 22 | SAURA JYAISHTHA | CHANDRA VAISAKHA | | | 1- Mohini Ekadasi (Smarta). |
| 2 | 23 | | | | | 2-Mohini Ekadasi (Vaishnava), Trisprisa Mahadvadasi. |
| 3 | 24 | | | | | |
| 4 | 25 | | | 4- Sun enters Rohini nak. ($8^{h}$ $46^{m}.6$) | | 4- Nrisimha Chaturdasi. |
| 5 | 26 | | | | 5- Full Moon ($16^{h}$ $43^{m}.9$) | 5-Vaisakhi Purnima, Buddha Purnima. |
| 6 | 27 | | | | 5- Total Lunar Eclipse(visible in India) | |
| 7 | 28 | | | | | |
| 8 | 29 | | | | 8- Sayana Vaidhriti ($19^{h}$ $26^{m}.3$) | |
| 9 | 30 | | | | | |
| 10 | 31 | | | | | |
| 11 | June 1 | | | | | |
| 12 | 2 | | | | | |
| 13 | 3 | | | | | |
| 14 | 4 | | | | | |
| 15 | 5 | | | | | |
| 16 | 6 | | | | | 16- Apara Ekadasi, Bhadrakali Ekadasi (Punjab). |
| 17 | 7 | | | | | |
| 18 | 8 | | | 18- Sun enters Mrigasiras nak. ($6^{h}$ $40^{m}.9$) | | 18- Savitri Chaturdasi. |
| 19 | 9 | | | | 20- New Moon ($16^{h}$ $22^{m}.6$) | 19- Phalaharini Kalika Puja. |
| 20 | 10 | | | | 20-Annular solar Eclipse (Not visible in India) | 20- Vata Savitri Vrata (Amavasya Paksha). |
| 21 | 11 | | CHANDRA JYAISHTHA | | | |
| 22 | 12 | | | | 22- Sayana Vyatipata ($06^{h}$ $11^{m}.9$) | |
| 23 | 13 | | | | | 23- Rambha Tritiya, Pratap Jayanti (Rajasthan). |
| 24 | 14 | | | 24- Saura Ashadhadi ($7^{h}$ $21^{m}.6$) | | 24- Guru Arjan Devôs Martyrdom Day (Sikh). |
| 25 | 15 | | | | | 25- Rajas Samkranti (Odisha). |
| 26 | 16 | SAURA ASHADHA | | | | 26- Vindhyavasini Puja, Aranya Shashthi (Bengal) or Jamatri Shashthi. |
| 27 | 17 | | | | | |
| 28 | 18 | | | | | 28- Mela Kshir Bhawani (Kashmir). |
| 29 | 19 | | | | | |
| 30 | 20 | | | | | 30- Ganga Dasahara. |
| 31 | June 21 | | | 31-Sun enters Trop. Cancer ($9^{h}$ $02^{m}.1$) | | 31- Dakshinayana Day, Nirjala Ekadasi. |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters:- Tula 2, $23^{h}$ $03^{m}.8$; Vrischika 4, $22^{h}$ $55^{m}.1$; Dhanus 6, $22^{h}$ $29^{m}.2$; Makara 8, $23^{h}$ $39^{m}.5$; Kumbha 10, $27^{h}$ $58^{m}.7$; Mina 13, $12^{h}$ $07^{m}.1$; Mesha 15, $23^{h}$ $27^{m}.6$; Vrisha 18, $12^{h}$ $23^{m}.1$; Mithuna 20, $25^{h}$ $09^{m}.6$; Karkata 23, $12^{h}$ $32^{m}.2$; Simha 25, $21^{h}$ $41^{m}.9$; Kanya 27, $28^{h}$ $07^{m}.4$; Tula 30, $7^{h}$ $42^{m}.4$;

Sun enters :-Nirayana Mithuna 25, $6^{h}$ $01^{m}.4$

# INDIAN CALENDAR

SAKA ERA 1943

Karkata : Nabhas

Month of ASHADHA (31 days)

Rains (Varsa), 1st Month

(*Nirayana*) 8 Ashadha, 5122 Kali Era to (*Nirayana)* 7 Sravana, 5122 Kali Era

| Date | Week Day | Gregorian Date | | Sunrise | | Apparent Noon | | Sunset | | Tithi No. | | Tithi Ending Moment | | Nakshatra No. | Nakshatra Ending Moment | | Yoga No. | Yoga Ending Moment | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | h | m | h | m | h | m | | | h | m | | h | m | | h | m |
| | | 2021 A.D. | | | | | | | | | | | | | | | | | |
| 1 | Tue | Jun | 22 | 5 | 15.4 | 12 | 02.0 | 18 | 48.7 | S | 12 | 10 | 22.4 | 16 | 14 | 22.4 | 21 | 13 | 50.9 |
| 2 | Wed | | 23 | 5 | 15.7 | 12 | 02.2 | 18 | 48.9 | | 13 | 7 | 00.1 | 17 | 11 | 48.0 | 22 | 9 | 59.6 |
| | | | | | | | | | | | (14 | 27 | 32.9) | | | | | | |
| 3 | Thu | | 24 | 5 | 15.9 | 12 | 02.4 | 18 | 49.0 | S | 15 | 24 | 09.7 | 18 | 9 | 10.8 | 23 | 6 | 05.4 |
| | | | | | | | | | | | | | | | | | (24 | 26 | 15.5) |
| 4 | Fri | | 25 | 5 | 16.2 | 12 | 02.7 | 18 | 49.2 | K | 1 | 20 | 59.6 | 19 | 6 | 40.0 | 25 | 22 | 37.2 |
| | | | | | | | | | | | | | | (20 | 28 | 25.4) | | | |
| 5 | Sat | | 26 | 5 | 16.5 | 12 | 02.9 | 18 | 49.3 | | 2 | 18 | 11.6 | 21 | 26 | 36.3 | 26 | 19 | 18.1 |
| 6 | Sun | | 27 | 5 | 16.7 | 12 | 03.1 | 18 | 49.4 | | 3 | 15 | 54.7 | 22 | 25 | 21.7 | 27 | 16 | 25.1 |
| 7 | Mon | | 28 | 5 | 17.0 | 12 | 03.3 | 18 | 49.5 | | 4 | 14 | 16.6 | 23 | 24 | 48.6 | 1 | 14 | 04.1 |
| 8 | Tue | | 29 | 5 | 17.4 | 12 | 03.5 | 18 | 49.6 | K | 5 | 13 | 23.6 | 24 | 25 | 01.9 | 2 | 12 | 19.5 |
| 9 | Wed | | 30 | 5 | 17.7 | 12 | 03.7 | 18 | 49.7 | | 6 | 13 | 18.9 | 25 | 26 | 03.1 | 3 | 11 | 13.6 |
| 10 | Thu | Jul. | 1 | 5 | 18.0 | 12 | 03.9 | 18 | 49.7 | | 7 | 14 | 02.2 | 26 | 27 | 49.3 | 4 | 10 | 45.8 |
| 11 | Fri | | 2 | 5 | 18.3 | 12 | 04.1 | 18 | 49.8 | | 8 | 15 | 29.1 | 27 | --- | --- | 5 | 10 | 52.7 |
| 12 | Sat | | 3 | 5 | 18.7 | 12 | 04.2 | 18 | 49.8 | | 9 | 17 | 31.0 | 27 | 6 | 13.6 | 6 | 11 | 27.9 |
| 13 | Sun | | 4 | 5 | 19.1 | 12 | 04.4 | 18 | 49.8 | K | 10 | 19 | 56.0 | 1 | 9 | 05.4 | 7 | 12 | 23.1 |
| 14 | Mon | | 5 | 5 | 19.4 | 12 | 04.6 | 18 | 49.7 | | 11 | 22 | 31.0 | 2 | 12 | 12.0 | 8 | 13 | 28.7 |
| 15 | Tue | | 6 | 5 | 19.8 | 12 | 04.8 | 18 | 49.7 | | 12 | 25 | 02.8 | 3 | 15 | 20.3 | 9 | 14 | 35.2 |
| 16 | Wed | | 7 | 5 | 20.2 | 12 | 04.9 | 18 | 49.6 | | 13 | 27 | 20.8 | 4 | 18 | 18.8 | 10 | 15 | 34.1 |
| 17 | Thu | | 8 | 5 | 20.6 | 12 | 05.1 | 18 | 49.5 | | 14 | 29 | 17.0 | 5 | 20 | 58.6 | 11 | 16 | 18.8 |
| 18 | Fri | | 9 | 5 | 21.0 | 12 | 05.2 | 18 | 49.4 | K | 30 | --- | --- | 6 | 23 | 13.9 | 12 | 16 | 44.5 |
| 19 | Sat | | 10 | 5 | 21.4 | 12 | 05.4 | 18 | 49.3 | K | 30 | 6 | 46.6 | 7 | 25 | 01.9 | 13 | 16 | 48.9 |
| 20 | Sun | | 11 | 5 | 21.8 | 12 | 05.5 | 18 | 49.2 | S | 1 | 7 | 47.6 | 8 | 26 | 21.9 | 14 | 16 | 30.7 |
| 21 | Mon | | 12 | 5 | 22.2 | 12 | 05.7 | 18 | 49.0 | | 2 | 8 | 20.0 | 9 | 27 | 14.4 | 15 | 15 | 50.2 |
| 22 | Tue | | 13 | 5 | 22.6 | 12 | 05.8 | 18 | 48.8 | | 3 | 8 | 24.5 | 10 | 27 | 40.8 | 16 | 14 | 48.1 |
| 23 | Wed | | 14 | 5 | 23.0 | 12 | 05.9 | 18 | 48.6 | | 4 | 8 | 02.9 | 11 | 27 | 42.6 | 17 | 13 | 25.4 |
| 24 | Thu | | 15 | 5 | 23.5 | 12 | 06.0 | 18 | 48.4 | S | 5 | 7 | 16.5 | 12 | 27 | 21.0 | 18 | 11 | 43.1 |
| 25 | Fri | | 16 | 5 | 23.9 | 12 | 06.1 | 18 | 48.1 | | 6 | 6 | 06.7 | 13 | 26 | 37.2 | 19 | 9 | 42.1 |
| | | | | | | | | | | | (7 | 28 | 34.6) | | | | | | |
| 26 | Sat | | 17 | 5 | 24.3 | 12 | 06.2 | 18 | 47.9 | | 8 | 26 | 41.6 | 14 | 25 | 32.3 | 20 | 7 | 23.2 |
| | | | | | | | | | | | | | | | | | (21 | 28 | 47.3) |
| 27 | Sun | | 18 | 5 | 24.7 | 12 | 06.3 | 18 | 47.6 | | 9 | 24 | 29.3 | 15 | 24 | 08.1 | 22 | 25 | 55.8 |
| 28 | Mon | | 19 | 5 | 25.2 | 12 | 06.3 | 18 | 47.3 | S | 10 | 22 | 00.2 | 16 | 22 | 27.0 | 23 | 22 | 50.4 |
| 29 | Tue | | 20 | 5 | 25.6 | 12 | 06.4 | 18 | 47.0 | | 11 | 19 | 17.8 | 17 | 20 | 32.6 | 24 | 19 | 34.2 |
| 30 | Wed | | 21 | 5 | 26.0 | 12 | 06.4 | 18 | 46.6 | | 12 | 16 | 26.8 | 18 | 18 | 29.8 | 25 | 16 | 10.8 |
| 31 | Thu | | 22 | 5 | 26.5 | 12 | 06.5 | 18 | 46.3 | S | 13 | 13 | 33.1 | 19 | 16 | 25.0 | 26 | 12 | 45.2 |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

**INDIAN CALENDAR**

SAKA ERA 1943

Dakshinayana
Uttara Gola

Month of ASHADHA (31 days)

Ayanamsa on 1st : $24^0 09^{\prime} 09^{\prime\prime}$

(*Nirayana*) 8 Ashadha, 5122 Kali Era to (*Nirayana)* 7 Sravana, 5122 Kali Era

| Date | Gregorian Date | Solar Month | Lunar Month | Transit of the Sun | Phenomena | Festivals |
|---|---|---|---|---|---|---|
| | 2021A.D. | | | | | |
| 1 | June 22 | SAURA ASHADHA | CHANDRA JYAISHTHA | 1- Enters Ardra nak. ($5^h 38^m.8$) | | 1- Champaka Dvadasi. |
| 2 | 23 | | | | | |
| 3 | 24 | | | | 3- Sayana Vaidhriti ($13^h 42^m.6$) | 3- Vata Savitri Vrata (Purnima Paksha), Deva Snana Purnima. |
| 4 | 25 | | | | | 4- Guru Hargobindôs Birthday(Jammu & Kashmir). |
| 5 | 26 | | | | 3- Full Moon ($24^h 09^m.7$) | |
| 6 | 27 | | | | | |
| 7 | 28 | | | | | |
| 8 | 29 | | | | | |
| 9 | 30 | | | | | |
| 10 | July 1 | | | | | |
| 11 | 2 | | | | | |
| 12 | 3 | | | | | |
| 13 | 4 | | | | | |
| 14 | 5 | | | 14- Sun enters Punarvasu nak. ($29^h 17^m.0$) | | 14- Yogini Ekadasi. |
| 15 | 6 | | | | | |
| 16 | 7 | | | | 16- Sayana Vyatipata ($12^h 28^m.9$) | |
| 17 | 8 | | | | | |
| 18 | 9 | | | | | |
| 19 | 10 | | | | 19- New Moon ($6^h 46^m.6$) | |
| 20 | 11 | | CHANDRA ASHADHA | | | 20- Manoratha Dvitiya Vrata (Bengal). |
| 21 | 12 | | | | | 21- Rathayatra. |
| 22 | 13 | | | | | 22- Martyrôs day (Kashmir). |
| 23 | 14 | | | | | |
| 24 | 15 | | | 24- Saura Sravanadi ($18^h 09^m.4$) | | 24- Kumara Shashthi (Vrata). |
| 25 | 16 | | | | | 25- Vivasvat Saptami, Manasa Puja Begins(Bengal). |
| 26 | 17 | SAURA SRAVANA | | | | 26- Kharchi Puja (Tripura). |
| 27 | 18 | | | | | 27- Mela Sharik Bhagwati (Kashmir). |
| 28 | 19 | | | 28- Sun enters Pushya nak. ($28^h 44^m.8$) | | 28- Punaryatra (Smarta). |
| 29 | 20 | | | | 29- Sayana Vaidhriti ($6^h 40^m.2$) | 29-Ultaratha (Odisha), Bahudha Yatra, Harisayani Ekadasi. |
| 30 | 21 | | | | | |
| 31 | July 22 | | | 31- Sun enters Trop.Leo ($19^h 56^m.4$) | | |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters:-Vrischika 1,$8^h 59^m.5$;Dhanus 3,$9^h 10^m.8$; Makara 5, $9^h 55^m.3$;Kumbha 7, $12^h 59^m.5$;Mina 9, $19^h 43^m.4$; Mesha 12,$6^h 13^m.6$;Vrisha 14,$18^h 59^m.4$; Mithuna 17,$7^h 41^m.4$; Karkata 19,$18^h 37^m.5$; Simha 21, $27^h 14^m.4$; Kanya 24, $9^h 39^m.3$;Tula 26,$14^h 07^m.3$;Vrischika 28, $16^h 53^m.6$; Dhanus 30,$18^h 29^m.8$; Sun enters:-Nirayana Karkata 25, $16^h 53^m.7$

SAKA ERA 1943

Simha : Nabhasya

Month of SRAVANA (31 days)

Rains (Varsa), 2nd Month

(*Nirayana*) 8 Sravana, 5122 Kali Era to (*Nirayana*) 7 Bhadra, 5122 Kali Era

| Date | Week Day | Gregorian Date | Sunrise | | Apparent Noon | | Sunset | | Tithi No. | Tithi Ending Moment | | Nakshatra No. | Nakshatra Ending Moment | | Yoga No. | Yoga Ending Moment | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | h | m | h | m | h | m | | h | m | | h | m | | h | m |
| | | 2021 A.D. | | | | | | | | | | | | | | | |
| 1 | Fri | Jul. 23 | 5 | 26.9 | 12 | 06.5 | 18 | 45.9 | S 14 | 10 | 43.8 | 20 | 14 | 25.7 | 27 | 9 | 23.0 |
| 2 | Sat | 24 | 5 | 27.3 | 12 | 06.5 | 18 | 45.5 | S 15 | 8 | 06.9 | 21 | 12 | 40.3 | 1 | 6 | 10.6 |
| | | | | | | | | | | | | | | | (2 | 27 | 14.8) |
| 3 | Sun | 25 | 5 | 27.8 | 12 | 06.5 | 18 | 45.0 | K 1 | 5 | 50.9 | 22 | 11 | 17.6 | 3 | 24 | 42.3 |
| | | | | | | | | | (2 | 28 | 04.3) | | | | | | |
| 4 | Mon | 26 | 5 | 28.2 | 12 | 06.5 | 18 | 44.6 | 3 | 26 | 54.9 | 23 | 10 | 26.3 | 4 | 22 | 39.3 |
| 5 | Tue | 27 | 5 | 28.7 | 12 | 06.5 | 18 | 44.1 | 4 | 26 | 28.8 | 24 | 10 | 13.8 | 5 | 21 | 10.2 |
| 6 | Wed | 28 | 5 | 29.1 | 12 | 06.5 | 18 | 43.7 | K 5 | 26 | 49.0 | 25 | 10 | 45.3 | 6 | 20 | 17.7 |
| 7 | Thu | 29 | 5 | 29.5 | 12 | 06.5 | 18 | 43.2 | 6 | 27 | 55.0 | 26 | 12 | 02.4 | 7 | 20 | 01.5 |
| 8 | Fri | 30 | 5 | 29.9 | 12 | 06.4 | 18 | 42.6 | 7 | --- | --- | 27 | 14 | 02.4 | 8 | 20 | 18.3 |
| 9 | Sat | 31 | 5 | 30.4 | 12 | 06.4 | 18 | 42.1 | 7 | 5 | 41.0 | 1 | 16 | 37.6 | 9 | 21 | 01.1 |
| 10 | Sun | Aug. 1 | 5 | 30.8 | 12 | 06.3 | 18 | 41.5 | 8 | 7 | 56.8 | 2 | 19 | 36.1 | 10 | 22 | 00.5 |
| 11 | Mon | 2 | 5 | 31.2 | 12 | 06.3 | 18 | 41.0 | 9 | 10 | 28.5 | 3 | 22 | 43.2 | 11 | 23 | 05.7 |
| 12 | Tue | 3 | 5 | 31.7 | 12 | 06.2 | 18 | 40.4 | K 10 | 13 | 00.3 | 4 | 25 | 43.8 | 12 | 24 | 05.4 |
| 13 | Wed | 4 | 5 | 32.1 | 12 | 06.1 | 18 | 39.8 | 11 | 15 | 17.9 | 5 | 28 | 24.9 | 13 | 24 | 50.2 |
| 14 | Thu | 5 | 5 | 32.5 | 12 | 06.0 | 18 | 39.2 | 12 | 17 | 09.7 | 6 | --- | --- | 14 | 25 | 12.8 |
| 15 | Fri | 6 | 5 | 32.9 | 12 | 05.9 | 18 | 38.5 | 13 | 18 | 28.6 | 6 | 6 | 37.1 | 15 | 25 | 08.8 |
| 16 | Sat | 7 | 5 | 33.3 | 12 | 05.8 | 18 | 37.9 | 14 | 19 | 11.8 | 7 | 8 | 15.5 | 16 | 24 | 36.7 |
| 17 | Sun | 8 | 5 | 33.7 | 12 | 05.6 | 18 | 37.2 | K 30 | 19 | 20.1 | 8 | 9 | 19.1 | 17 | 23 | 37.5 |
| 18 | Mon | 9 | 5 | 34.1 | 12 | 05.5 | 18 | 36.5 | S 1 | 18 | 56.7 | 9 | 9 | 50.0 | 18 | 22 | 13.7 |
| 19 | Tue | 10 | 5 | 34.5 | 12 | 05.4 | 18 | 35.8 | 2 | 18 | 06.4 | 10 | 9 | 52.6 | 19 | 20 | 28.9 |
| 20 | Wed | 11 | 5 | 34.9 | 12 | 05.2 | 18 | 35.1 | 3 | 16 | 54.3 | 11 | 9 | 31.7 | 20 | 18 | 27.0 |
| 21 | Thu | 12 | 5 | 35.3 | 12 | 05.0 | 18 | 34.4 | 4 | 15 | 25.2 | 12 | 8 | 52.6 | 21 | 16 | 11.5 |
| 22 | Fri | 13 | 5 | 35.7 | 12 | 04.9 | 18 | 33.6 | S 5 | 13 | 43.2 | 13 | 7 | 59.5 | 22 | 13 | 45.6 |
| 23 | Sat | 14 | 5 | 36.1 | 12 | 04.7 | 18 | 32.8 | 6 | 11 | 51.4 | 14 | 6 | 55.9 | 23 | 11 | 11.5 |
| 24 | Sun | 15 | 5 | 36.5 | 12 | 04.5 | 18 | 32.1 | 7 | 9 | 51.8 | 15 | 5 | 44.1 | 24 | 8 | 31.1 |
| | | | | | | | | | | | | (16 | 28 | 25.8) | | | |
| 25 | Mon | 16 | 5 | 36.9 | 12 | 04.3 | 18 | 31.3 | 8 | 7 | 46.0 | 17 | 27 | 02.3 | 25 | 5 | 45.5 |
| | | | | | | | | | (9 | 29 | 35.2) | | | | (26 | 26 | 55.6) |
| 26 | Tue | 17 | 5 | 37.2 | 12 | 04.1 | 18 | 30.5 | S 10 | 27 | 21.1 | 18 | 25 | 35.3 | 27 | 24 | 02.8 |
| 27 | Wed | 18 | 5 | 37.6 | 12 | 03.9 | 18 | 29.7 | 11 | 25 | 06.3 | 19 | 24 | 07.3 | 1 | 21 | 09.0 |
| 28 | Thu | 19 | 5 | 38.0 | 12 | 03.6 | 18 | 28.8 | 12 | 22 | 54.5 | 20 | 22 | 42.0 | 2 | 18 | 17.0 |
| 29 | Fri | 20 | 5 | 38.3 | 12 | 03.4 | 18 | 28.0 | 13 | 20 | 50.6 | 21 | 21 | 24.6 | 3 | 15 | 30.5 |
| 30 | Sat | 21 | 5 | 38.7 | 12 | 03.1 | 18 | 27.1 | 14 | 19 | 00.8 | 22 | 20 | 21.4 | 4 | 12 | 54.1 |
| 31 | Sun | 22 | 5 | 39.1 | 12 | 02.9 | 18 | 26.3 | S 15 | 17 | 32.0 | 23 | 19 | 39.5 | 5 | 10 | 33.2 |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

Dakshinayana
Uttara Gola

SAKA ERA 1943
Month of SRAVANA (31 days)

Ayanamsa on 1st : 24°09′15″

*(Nirayana)* 8 Sravana, 5122 Kali Era to *(Nirayana)* 7 Bhadra, 5122 Kali Era

| Date | Gergorian Date | Solar Month | Lunar Month | Transit of the Sun | Phenomena | Festivals |
|---|---|---|---|---|---|---|
| | 2021 A.D. | | | | | |
| 1 | July 23 | SAURA SRAVANA | ASHADHA | | | 1- Mela Jwalamukhi (Kashmir). |
| 2 | 24 | | | | 2- Full Moon ($8^h06^m.9$) | 2- Guru Purnima, Vyasa Puja, Asadhi Purnima. |
| 3 | 25 | | | | | |
| 4 | 26 | | | | | |
| 5 | 27 | | | | | |
| 6 | 28 | | | | | 6- Naga Panchami (Bengal). |
| 7 | 29 | | | | | |
| 8 | 30 | | | | | |
| 9 | 31 | | CHANDRA | | | 9- Ker Puja (Tripura). |
| 10 | Aug. 1 | | | | 10- Sayana Vyatipata ($18^h55^m.5$) | 10- Tilak Commemoration Day. |
| 11 | 2 | | | 11- Sun enters Aslesha nak. ($27^h42^m.4$) | | |
| 12 | 3 | | | | | |
| 13 | 4 | | | | | 13- Kamika Ekadasi. |
| 14 | 5 | | | | | 17- Chitalagi Amavasya (Odisha), Adi Amavasya (Tamil Nadu), Karkataka Vavu (Kerala). |
| 15 | 6 | | | | | |
| 16 | 7 | | | | | 19- Adi Puram (S. India). |
| 17 | 8 | | | | 17- New moon ($19^h20^m.1$) | 20- Madhusrava Tritiya (Teej). |
| 18 | 9 | | CHANDRA SRAVANA | | | 22- Naga Panchami. 24- Goswami Tulasidas Jayanti, Independence Day. |
| 19 | 10 | | | | 19- Mars sets in West ($27^h22^m$) | |
| 20 | 11 | | | | | 26- Simhadi (Kerala), Manasa Puja Ends (Bengal), Beginning of Kollam Era. |
| 21 | 12 | | | | | |
| 22 | 13 | | | | | 27- Jhulana Yatrarambha (Purvahna), Pavitra Ekadasi. |
| 23 | 14 | | | | 23- Sayana Vaidhriti ($19^h 13^m.4$) | |
| 24 | 15 | | | 24- Saura Bhadrapadadi ($26^h41^m.3$) | | 29- Vara Maha Lakshmi Vrata (S.India), First Onam Day. |
| 25 | 16 | | | | | 30- Rik Upakarma, Onam or Thiru Onam Day (Kerala), Jhulana Yatra Samapanna (Pradosa). |
| 26 | 17 | SAURA BHADRAPADA | | 25- Sun enters Magha nak. ($25^h17^m.4$) | | |
| 27 | 18 | | | | | 31- Raksha Bandhan, Amarnath Yatra, Balabhadra Puja (Odisha), Naroli Purnima, Solono (Rakhi Bandhan), Avani Avittam (S.India), Yaju Upakarma, Third Onam Day, Jhulana Yatra Samapanna, Sravani Purnima. |
| 28 | 19 | | | | | |
| 29 | 20 | | | | | |
| 30 | 21 | | | 31- Sun enters trop. Vigro ($27^h04^m.9$) | 31- Full moon ($17^h 32^m.0$) | |
| 31 | Aug. 22 | | | | | |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Makara 1, $19^h 57^m.7$; Kumbha 3, $22^h 47^m.6$; Mina 5, $28^h 33^m.1$; Mesha 8, $14^h 02^m.3$; Vrisha 10, $26^h 22^m.7$; Mithuna 13, $15^h 07^m.5$; Karkata 15, $25^h 54^m.2$; Simha 18, $9^h 50^m.0$; Kanya 20, $15^h 23^m.5$; Tula 22, $19^h 28^m.8$; Vrischika 24, $22^h 45^m.9$; Dhanus 26, $25^h 35^m.3$; Makara 28, $28^h 21^m.7$; Kumbha 31, $7^h 57^m.3$; Sun enters: Nirayana Simha 25, $25^h 17^m.4$.

SAKA ERA 1943

Kanya: Isha

Month of BHADRA (31 days) Autumn (Sarat), 1st Month

(*Nirayana*) 8 Bhadra, 5122 Kali Era to (*Nirayana*) 7 Asvina, 5122 Kali Era

| Date | Week Day | Gregorian Date | Sunrise | | Apparent Noon | | Sunset | | Tithi | | | Nakshatra | | | Yoga | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | No. | Ending Moment | | No. | Ending Moment | | No. | Ending Moment | |
| | | | h | m | h | m | h | m | | h | m | | h | m | | h | m |
| | | 2021 A.D. | | | | | | | | | | | | | | | |
| 1 | Mon | Aug. 23 | 5 | 39.4 | 12 | 02.6 | 18 | 25.4 | K 1 | 16 | 31.4 | 24 | 19 | 26.0 | 6 | 8 | 33.2 |
| 2 | Tue | 24 | 5 | 39.7 | 12 | 02.4 | 18 | 24.5 | 2 | 16 | 05.4 | 25 | 19 | 47.4 | 7 | 6 | 59.3 |
| 3 | Wed | 25 | 5 | 40.1 | 12 | 02.1 | 18 | 23.6 | 3 | 16 | 19.1 | 26 | 20 | 48.0 | 8 | 5 | 55.5 |
| | | | | | | | | | | | | | | | (9 | 29 | 24.1) |
| 4 | Thu | 26 | 5 | 40.4 | 12 | 01.8 | 18 | 22.7 | 4 | 17 | 14.4 | 27 | 22 | 29.1 | 10 | 29 | 24.6 |
| 5 | Fri | 27 | 5 | 40.8 | 12 | 01.5 | 18 | 21.8 | K 5 | 18 | 49.4 | 1 | 24 | 47.4 | 11 | --- | --- |
| 6 | Sat | 28 | 5 | 41.1 | 12 | 01.2 | 18 | 20.9 | 6 | 20 | 57.1 | 2 | 27 | 34.8 | 11 | 5 | 53.4 |
| 7 | Sun | 29 | 5 | 41.4 | 12 | 00.9 | 18 | 19.9 | 7 | 23 | 25.7 | 3 | --- | --- | 12 | 6 | 43.6 |
| 8 | Mon | 30 | 5 | 41.8 | 12 | 00.6 | 18 | 19.0 | 8 | 26 | 00.1 | 3 | 6 | 38.8 | 13 | 7 | 45.5 |
| 9 | Tue | 31 | 5 | 42.1 | 12 | 00.3 | 18 | 18.0 | 9 | 28 | 23.9 | 4 | 9 | 43.9 | 14 | 8 | 47.8 |
| 10 | Wed | Sept. 1 | 5 | 42.4 | 12 | 00.0 | 18 | 17.1 | K 10 | --- | --- | 5 | 12 | 34.4 | 15 | 9 | 38.8 |
| 11 | Thu | 2 | 5 | 42.7 | 11 | 59.7 | 18 | 16.1 | K 10 | 6 | 22.3 | 6 | 14 | 56.8 | 16 | 10 | 08.5 |
| 12 | Fri | 3 | 5 | 43.1 | 11 | 59.3 | 18 | 15.1 | 11 | 7 | 44.5 | 7 | 16 | 41.8 | 17 | 10 | 09.4 |
| 13 | Sat | 4 | 5 | 43.4 | 11 | 59.0 | 18 | 14.2 | 12 | 8 | 24.7 | 8 | 17 | 45.0 | 18 | 9 | 37.3 |
| 14 | Sun | 5 | 5 | 43.7 | 11 | 58.7 | 18 | 13.2 | 13 | 8 | 21.8 | 9 | 18 | 06.9 | 19 | 8 | 31.4 |
| 15 | Mon | 6 | 5 | 44.0 | 11 | 58.4 | 18 | 12.2 | 14 | 7 | 38.9 | 10 | 17 | 51.4 | 20 | 6 | 53.6 |
| | | | | | | | | | | | | | | | (21 | 28 | 48.2) |
| 16 | Tue | 7 | 5 | 44.3 | 11 | 58.0 | 18 | 11.2 | K 30 | 6 | 21.8 | 11 | 17 | 05.1 | 22 | 26 | 20.4 |
| | | | | | | | | | (S 1 | 28 | 37.6) | | | | | | |
| 17 | Wed | 8 | 5 | 44.6 | 11 | 57.7 | 18 | 10.2 | 2 | 26 | 34.1 | 12 | 15 | 55.6 | 23 | 23 | 36.2 |
| 18 | Thu | 9 | 5 | 44.9 | 11 | 57.3 | 18 | 09.2 | 3 | 24 | 18.8 | 13 | 14 | 30.7 | 24 | 20 | 41.5 |
| 19 | Fri | 10 | 5 | 45.2 | 11 | 57.0 | 18 | 08.2 | 4 | 21 | 58.2 | 14 | 12 | 57.7 | 25 | 17 | 41.6 |
| 20 | Sat | 11 | 5 | 45.5 | 11 | 56.6 | 18 | 07.2 | S 5 | 19 | 37.7 | 15 | 11 | 22.6 | 26 | 14 | 40.8 |
| 21 | Sun | 12 | 5 | 45.9 | 11 | 56.3 | 18 | 06.2 | 6 | 17 | 21.1 | 16 | 9 | 50.1 | 27 | 11 | 42.7 |
| 22 | Mon | 13 | 5 | 46.2 | 11 | 55.9 | 18 | 05.2 | 7 | 15 | 11.2 | 17 | 8 | 23.5 | 1 | 8 | 49.4 |
| 23 | Tue | 14 | 5 | 46.5 | 11 | 55.6 | 18 | 04.1 | 8 | 13 | 09.7 | 18 | 7 | 04.7 | 2 | 6 | 02.6 |
| | | | | | | | | | | | | | | | (3 | 27 | 23.3) |
| 24 | Wed | 15 | 5 | 46.8 | 11 | 55.2 | 18 | 03.1 | 9 | 11 | 17.8 | 19 | 5 | 55.1 | 4 | 24 | 52.3 |
| | | | | | | | | | | | | (20 | 28 | 55.8) | | | |
| 25 | Thu | 16 | 5 | 47.1 | 11 | 54.8 | 18 | 02.1 | S 10 | 9 | 36.7 | 21 | 28 | 08.6 | 5 | 22 | 30.7 |
| 26 | Fri | 17 | 5 | 47.4 | 11 | 54.5 | 18 | 01.1 | 11 | 8 | 08.2 | 22 | 27 | 35.8 | 6 | 20 | 20.3 |
| 27 | Sat | 18 | 5 | 47.7 | 11 | 54.1 | 18 | 00.1 | 12 | 6 | 54.9 | 23 | 27 | 20.9 | 7 | 18 | 23.5 |
| 28 | Sun | 19 | 5 | 48.0 | 11 | 53.8 | 17 | 59.0 | 13 | 6 | 00.2 | 24 | 27 | 28.1 | 8 | 16 | 43.2 |
| | | | | | | | | | (14 | 29 | 28.7) | | | | | | |
| 29 | Mon | 20 | 5 | 48.3 | 11 | 53.4 | 17 | 58.0 | S 15 | 29 | 24.7 | 25 | 28 | 02.0 | 9 | 15 | 22.7 |
| 30 | Tue | 21 | 5 | 48.6 | 11 | 53.1 | 17 | 57.0 | K 1 | --- | --- | 26 | 29 | 06.3 | 10 | 14 | 25.3 |
| 31 | Wed | 22 | 5 | 48.9 | 11 | 52.7 | 17 | 56.0 | K 1 | 5 | 52.4 | 27 | --- | --- | 11 | 13 | 53.3 |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

SAKA ERA 1943

Dakshinayana

Uttara Gola

Month of BHADRA (31 days)

Ayanamsa on 1st : 24° 09′ 20″

(*Nirayana*) 8 Bhadra, 5122 Kali Era to (*Nirayana)* 7 Asvina, 5122 Kali Era

| Date | Gregorian Date | Solar Month | Lunar Month | Transit of the Sun | Phenomena | Festivals |
|---|---|---|---|---|---|---|
| | 2021 A.D. | | | | | |
| 1 | Aug. 23 | SAURA BHADRAPADA | CHANDRA SRAVANA | | | 1- Gayatri Japam, Sri Narayan Guru Devaôs Birthday (Kerala), Fourth Onam Day. |
| 2 | 24 | | | | | |
| 3 | 25 | | | | | 3-Bahula Chaturthi (Sankashta Chaturthi), Teejri (Sindhi). |
| 4 | 26 | | | | 4- Sayana Vyatipata ($26^h\ 27^m.2$) | 4-Raksha Panchami (Odisha). |
| 5 | 27 | | | | | 5-Tithi of Sri Madhava Deva (Assam). |
| 6 | 28 | | | | | |
| 7 | 29 | | | | | 7-Vadi Thadri (Sindhi). |
| 8 | 30 | | | 8- Sun enters Purva Phalguni nak. ($21^h\ 20^m.2$) | | 8- Janmashtami , Janmashtami (Jayanti Yoga), Sri Krishna Jayanti (T.N., Assam & Kerala), Durvashtami (Except Bengal). |
| 9 | 31 | | | | | 9- Gokulashtami (Nandotsava), Sri Jayanti (Ramanuja). |
| 10 | Sept. 1 | | | | | |
| 11 | 2 | | | | | |
| 12 | 3 | | | | | 12- Keil Muhurth(Coorg), Aja Ekadasi, Paryusana Parvarambha (Chaturthi Paksha- Jain). |
| 13 | 4 | | | | | 13- Paryusana Parvarambha (Panchami Paksha-Jain). |
| 14 | 5 | | | | | 14- Kailas Yatra- 2 days, Aghora Chaturdasi. |
| 15 | 6 | | | | | 15- Saptapuri Amavasya (Odisha), Kusotpatini, Pithori. |
| 16 | 7 | | CHANDRA BHADRAPADA | | 16- New Moon ($6^h\ 21^m.8$) | 16- Jain Fstival. |
| 17 | 8 | | | | | 17- Tithi of Sri Sankara Deva (Assam). |
| 18 | 9 | | | | 18- Sayana Vaidhriti ($7^h\ 33^m.5$) | 18- Haritalika Gauri Tritiya. |
| 19 | 10 | | | | | 19- Ganesha Chaturthi, Vinayak Chaturthi(T.N.), Haritalika Chaturthi, Samvatsari(Chaturthi Paksha -Jain). |
| 20 | 11 | | | | | 20-Samvatsari (Panchami Paksha-Jain), Rishi Panchami, Mela Pat-3 days (Jammu & Kashmir). |
| 21 | 12 | | | | | 21-Surya Shashthi. |
| 22 | 13 | | | 22- Sun enters Uttara Phalguni nak. ($15^h\ 06^m.8$) | | 22- Maha Lakshmi Vratarambha. |
| 23 | 14 | | | | 23- Jupiter enters into Makara ($14^h\ 21^m.7$) | 23-Durvashtami(Bengal), Radhashtami. |
| 24 | 15 | | | 24- Saura Asvinadi ($26^h\ 55^m.1$) | | |
| 25 | 16 | | | | | |
| 26 | 17 | SAURA ASVINA | | | | 26-Dol Gyaras (MP), Heikru Hidongba (Manipur), Parsva Parivartini Ekadasi, Sravana Dvadasi, Vamana Jayanti, Sakrotthana, VisvakarmaPuja. |
| 27 | 18 | | | | | |
| 28 | 19 | | | | | 28- Ananta Chaturdasi. |
| 29 | 20 | | | | 29- Full Moon ($29^h\ 24^m.7$) | 29- Indra Purnima. |
| 30 | 21 | | | | 30- Sayana Vyatipata ($11^h\ 35^m.4$) | 30- Pitri Paksha Tarpara Begins or Mahalaya Paksha Begins (S.India), Samadhi day of Narayan Guru (Kerala). |
| 31 | Sept. 22 | | | 31- Sun enters Trop. Libra ($24^h\ 51^m.0$) | | |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters : Mina 2, $13^h\ 38^m.4$; Mesha 4, $22^h\ 29^m.1$; Vrisha 7, $10^h\ 19^m.8$; Mithuna 9, $23^h\ 11^m.9$; Karkata 12, $10^h\ 19^m.4$; Simha 14, $18^h\ 06^m.9$; Kanya 16, $22^h\ 44^m.8$; Tula 18, $25^h\ 44^m.8$; Vrischika 20, $28^h\ 12^m.8$; Dhanus 23, $7^h\ 04^m.7$; Makara 25, $10^h\ 42^m.8$; Kumbha 27, $15^h\ 25^m.9$; Mina 29, $21^h\ 50^m.8$

Sun enters :- Nirayana Kanya 25, $25^h\ 36^m.6$.

SAKA ERA 1943

Tula : Urja

Month of ASVINA (30 days) Autumn (Sarat), 2nd Month

(*Nirayana*) 8 Asvina, 5122 Kali Era to (*Nirayana)* 7 Kartika, 5122 Kali Era

| Date | Week Day | Gregorian Date | Sunrise | | Apparent Noon | | Sunset | | Tithi | | | Nakshatra | | | Yoga | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | No. | Ending Moment | | No. | Ending Moment | | No. | Ending Moment | |
| | | | h | m | h | m | h | m | | h | m | | h | m | | h | m |
| | | 2021 A.D. | | | | | | | | | | | | | | | |
| 1 | Thu | Sep. 23 | 5 | 49.2 | 11 | 52.4 | 17 | 55.0 | K 2 | 6 | 54.3 | 27 | 6 | 43.7 | 12 | 13 | 47.9 |
| 2 | Fri | 24 | 5 | 49.6 | 11 | 52.0 | 17 | 53.9 | 3 | 8 | 30.3 | 1 | 8 | 54.0 | 13 | 14 | 08.1 |
| 3 | Sat | 25 | 5 | 49.9 | 11 | 51.7 | 17 | 52.9 | 4 | 10 | 36.6 | 2 | 11 | 33.1 | 14 | 14 | 50.0 |
| 4 | Sun | 26 | 5 | 50.2 | 11 | 51.3 | 17 | 51.9 | K 5 | 13 | 05.2 | 3 | 14 | 33.0 | 15 | 15 | 47.3 |
| 5 | Mon | 27 | 5 | 50.5 | 11 | 51.0 | 17 | 50.9 | 6 | 15 | 43.7 | 4 | 17 | 41.5 | 16 | 16 | 50.9 |
| 6 | Tue | 28 | 5 | 50.9 | 11 | 50.6 | 17 | 49.9 | 7 | 18 | 17.2 | 5 | 20 | 44.0 | 17 | 17 | 50.0 |
| 7 | Wed | 29 | 5 | 51.2 | 11 | 50.3 | 17 | 48.9 | 8 | 20 | 30.1 | 6 | 23 | 25.5 | 18 | 18 | 33.7 |
| 8 | Thu | 30 | 5 | 51.5 | 11 | 50.0 | 17 | 47.9 | 9 | 22 | 08.9 | 7 | 25 | 33.0 | 19 | 18 | 52.1 |
| 9 | Fri | Oct. 1 | 5 | 51.9 | 11 | 49.6 | 17 | 46.9 | K 10 | 23 | 04.0 | 8 | 26 | 57.5 | 20 | 18 | 37.6 |
| 10 | Sat | 2 | 5 | 52.2 | 11 | 49.3 | 17 | 46.0 | 11 | 23 | 11.0 | 9 | 27 | 34.9 | 21 | 17 | 46.1 |
| 11 | Sun | 3 | 5 | 52.6 | 11 | 49.0 | 17 | 45.0 | 12 | 22 | 30.1 | 10 | 27 | 26.0 | 22 | 16 | 16.6 |
| 12 | Mon | 4 | 5 | 52.9 | 11 | 48.7 | 17 | 44.0 | 13 | 21 | 05.7 | 11 | 26 | 35.3 | 23 | 14 | 11.1 |
| 13 | Tue | 5 | 5 | 53.3 | 11 | 48.4 | 17 | 43.1 | 14 | 19 | 04.6 | 12 | 25 | 10.2 | 24 | 11 | 34.2 |
| 14 | Wed | 6 | 5 | 53.6 | 11 | 48.1 | 17 | 42.1 | K 30 | 16 | 35.4 | 13 | 23 | 19.6 | 25 | 8 | 32.0 |
| | | | | | | | | | | | | | | | (26 | 29 | 11.2) |
| 15 | Thu | 7 | 5 | 54.0 | 11 | 47.8 | 17 | 41.2 | S 1 | 13 | 47.1 | 14 | 21 | 12.8 | 27 | 25 | 39.2 |
| 16 | Fri | 8 | 5 | 54.4 | 11 | 47.5 | 17 | 40.2 | 2 | 10 | 49.0 | 15 | 18 | 59.2 | 1 | 22 | 03.1 |
| 17 | Sat | 9 | 5 | 54.8 | 11 | 47.3 | 17 | 39.3 | 3 | 7 | 49.4 | 16 | 16 | 47.2 | 2 | 18 | 29.1 |
| | | | | | | | | | (4 | 28 | 55.9) | | | | | | |
| 18 | Sun | 10 | 5 | 55.2 | 11 | 47.0 | 17 | 38.4 | S 5 | 26 | 14.8 | 17 | 14 | 44.0 | 3 | 15 | 02.8 |
| 19 | Mon | 11 | 5 | 55.5 | 11 | 46.7 | 17 | 37.5 | 6 | 23 | 51.1 | 18 | 12 | 55.6 | 4 | 11 | 48.6 |
| 20 | Tue | 12 | 5 | 55.9 | 11 | 46.5 | 17 | 36.6 | 7 | 21 | 48.1 | 19 | 11 | 26.3 | 5 | 8 | 49.9 |
| 21 | Wed | 13 | 5 | 56.4 | 11 | 46.2 | 17 | 35.7 | 8 | 20 | 08.3 | 20 | 10 | 18.9 | 6 | 6 | 08.9 |
| | | | | | | | | | | | | | | | (7 | 27 | 46.9) |
| 22 | Thu | 14 | 5 | 56.8 | 11 | 46.0 | 17 | 34.8 | 9 | 18 | 52.9 | 21 | 9 | 35.2 | 8 | 25 | 44.7 |
| 23 | Fri | 15 | 5 | 57.2 | 11 | 45.8 | 17 | 33.9 | S 10 | 18 | 02.6 | 22 | 9 | 16.0 | 9 | 24 | 02.4 |
| 24 | Sat | 16 | 5 | 57.6 | 11 | 45.6 | 17 | 33.1 | 11 | 17 | 38.0 | 23 | 9 | 21.7 | 10 | 22 | 40.3 |
| 25 | Wed | 17 | 5 | 58.0 | 11 | 45.3 | 17 | 32.2 | 12 | 17 | 39.6 | 24 | 9 | 52.7 | 11 | 21 | 38.6 |
| 26 | Mon | 18 | 5 | 58.5 | 11 | 45.1 | 17 | 31.4 | 13 | 18 | 07.8 | 25 | 10 | 49.4 | 12 | 20 | 57.7 |
| 27 | Tue | 19 | 5 | 58.9 | 11 | 45.0 | 17 | 30.6 | 14 | 19 | 03.5 | 26 | 12 | 12.3 | 13 | 20 | 37.8 |
| 28 | Wed | 20 | 5 | 59.4 | 11 | 44.8 | 17 | 29.8 | S 15 | 20 | 26.7 | 27 | 14 | 01.8 | 14 | 20 | 38.8 |
| 29 | Thu | 21 | 5 | 59.8 | 11 | 44.6 | 17 | 29.0 | K 1 | 22 | 16.5 | 1 | 16 | 17.0 | 15 | 20 | 59.8 |
| 30 | Wed | 22 | 6 | 00.3 | 11 | 44.5 | 17 | 28.2 | K 2 | 24 | 30.1 | 2 | 18 | 55.7 | 16 | 21 | 38.8 |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

**INDIAN CALENDAR**

SAKA ERA 1943

Dakshinayana
Dakshina Gola

Month of ASVINA (30 days)

Ayanamsa on 1st : 24°09′23″

(*Nirayana*) 8 Asvina, 5122 Kali Era to (*Nirayana*) 7 Kartika, 5122 Kali Era

| Date | Gregorian Date | Solar Month | Lunar Month | Transit of the Sun | Phenomena | Festivals |
|---|---|---|---|---|---|---|
| | 2021 A.D. | | | | | |
| 1 | Sept. 23 | SAURA ASVINA | CHANDRA BHADRAPADA | | | 1- Jalavisuva Day. |
| 2 | 24 | | | | | |
| 3 | 25 | | | | | |
| 4 | 26 | | | | | |
| 5 | 27 | | | 5- Sun enters Hasta nak. ($6^h42^m.2$) | | |
| 6 | 28 | | | | | 6- Mahalakshmi Vrata Samapanna. |
| 7 | 29 | | | | | |
| 8 | 30 | | | | | 8- Matri Navami. |
| 9 | Oct. 1 | | | | | |
| 10 | 2 | | | | | 10- Indira Ekadasi, Mahatma Gandhi's Birthday. |
| 11 | 3 | | | | | |
| 12 | 4 | | | | 12- Sayana Vaiidhriti ($22^h 13^m.5$) | |
| 13 | 5 | | | | | |
| 14 | 6 | | | | 14- New Moon ($16^h 35^m.4$) | 14-Mahalaya Amavasya, Sarva Pitri Amavasya , Tarpana Layba (Manipur), Gajacchaya Parva . |
| 15 | 7 | | CHANDRA ASVINA | | | 15- Saradiya Navaratrarambha, Maharaja Agrasen's Jayanti. |
| 16 | 8 | | | | | |
| 17 | 9 | | | | | |
| 18 | 10 | | | 18- Sun enters Chitra nak. ($19^h38^m.1$) | | 18-Upanga LalitaVrata(Lalita Panchami) |
| 19 | 11 | | | | | 19- Saraswati Avahana. |
| 20 | 12 | | | | | 20-Durga Puja begins (Saptami), Oli begins(Jain). |
| 21 | 13 | | | | | 21-Mahashtami. |
| 22 | 14 | | | | | 22-Mahanavami,Ayudha Puja, Saraswati Visarjana. |
| 23 | 15 | | | | | 23-Vijaya Dasami (Dussehara or Dasahara), Vijaya Dasami (Bengal & Kerala), Madhavacharya Jayanti. |
| 24 | 16 | | | 24- Saura Kartikadi ($15^h 15^m.3$) | 24- Sayana Vyatipata ($19^h 54^m.3$) | 24- Bharat Milap, Papankusa Ekadasi (Pasankusa). |
| 25 | 17 | | | | | 25-Kaveri Samkramana Snana. |
| 26 | 18 | SAURA KARTIKA | | | | |
| 27 | 19 | | | | | 27- Kojagor (Lakshmindra Puja). |
| 28 | 20 | | | | 28- Full Moon ($20^h 26^m.7$) | 28- Kumara Purnima (Odisha), Kojagori Lakshmi Puja (Bengal), Maharshi Valmiki's Birthday, Oli Ends (Jain), Sarat Purnima. |
| 29 | 21 | | | | | |
| 30 | Oct. 22 | | | | | |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Mesha 1, $6^h 43^m.7$; Vrisha 3, $18^h 16^m.5$; Mithuna 6, $7^h 14^m.4$; Karkata 8, $19^h 04^m.9$; Simha 10, $27^h 34^m.9$; Kanya 13, $8^h 16^m.9$; Tula 15, $10^h 17^m.6$; Vrischika 17, $11^h 19^m.6$; Dhanus 19, $12^h 55^m.6$; Makara 21, $16^h 05^m.7$; Kumbha 23, $21^h 15^m.7$; Mina 25, $28^h 32^m.7$; Mesha 28, $14^h 01^m.8$; Vrisha 30, $25^h 38^m.5$ Sun enters :- Nirayana Tula 25, $13^h 12^m.4$.

# INDIAN CALENDAR

SAKA ERA 1943

Vrischika : Sahas
Hemanta, 1st Month

Month of KARTIKA (30 days)

(*Nirayana*) 8 Kartika, 5122 Kali Era to (*Nirayana*) 7 Agrahayana, 5122 Kali Era

| Date | Week Day | Gregorian Date | | Sunrise | | Apparent Noon | | Sunset | | Tithi No. | | Tithi Ending Moment | | Nakshatra No. | Nakshatra Ending Moment | | Yoga No. | Yoga Ending Moment | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | h | m | h | m | h | m | | | h | m | | h | m | | h | m |
| | | 2021 A.D. | | | | | | | | | | | | | | | | | |
| 1 | Sat | Oct. | 23 | 6 | 00.8 | 11 | 44.3 | 17 | 27.5 | K | 3 | 27 | 02.1 | 3 | 21 | 53.1 | 17 | 22 | 31.9 |
| 2 | Sun | | 24 | 6 | 01.3 | 11 | 44.2 | 17 | 26.7 | | 4 | 29 | 43.9 | 4 | 25 | 01.5 | 18 | 23 | 33.5 |
| 3 | Mon | | 25 | 6 | 01.8 | 11 | 44.1 | 17 | 26.2 | K | 5 | --- | --- | 5 | 28 | 10.6 | 19 | 24 | 36.0 |
| 4 | Tue | | 26 | 6 | 02.3 | 11 | 44.0 | 17 | 25.3 | K | 5 | 8 | 24.5 | 6 | --- | --- | 20 | 25 | 30.7 |
| 5 | Wed | | 27 | 6 | 02.8 | 11 | 43.9 | 17 | 24.6 | | 6 | 10 | 50.7 | 6 | 7 | 08.1 | 21 | 26 | 08.2 |
| 6 | Thu | | 28 | 6 | 03.3 | 11 | 43.8 | 17 | 23.9 | | 7 | 12 | 49.6 | 7 | 9 | 41.2 | 22 | 26 | 19.7 |
| 7 | Fri | | 29 | 6 | 03.8 | 11 | 43.7 | 17 | 23.2 | | 8 | 14 | 09.9 | 8 | 11 | 38.4 | 23 | 25 | 58.2 |
| 8 | Sat | | 30 | 6 | 04.4 | 11 | 43.6 | 17 | 22.6 | | 9 | 14 | 43.7 | 9 | 12 | 51.5 | 24 | 24 | 59.1 |
| 9 | Sun | | 31 | 6 | 04.9 | 11 | 43.6 | 17 | 22.0 | K | 10 | 14 | 27.5 | 10 | 13 | 16.2 | 25 | 23 | 20.6 |
| 10 | Mon | Nov. | 1 | 6 | 05.5 | 11 | 43.6 | 17 | 21.4 | | 11 | 13 | 22.0 | 11 | 12 | 52.5 | 26 | 21 | 03.9 |
| 11 | Tue | | 2 | 6 | 06.0 | 11 | 43.5 | 17 | 20.8 | | 12 | 11 | 31.4 | 12 | 11 | 44.2 | 27 | 18 | 12.6 |
| 12 | Wed | | 3 | 6 | 06.6 | 11 | 43.5 | 17 | 20.2 | | 13 | 9 | 02.4 | 13 | 9 | 58.0 | 1 | 14 | 52.2 |
| | | | | | | | | | | | (14 | 30 | 03.7) | | | | | | |
| 13 | Thu | | 4 | 6 | 07.2 | 11 | 43.6 | 17 | 19.7 | K | 30 | 26 | 44.6 | 14 | 7 | 42.4 | 2 | 11 | 09.5 |
| | | | | | | | | | | | | | | (15 | 29 | 07.3) | | | |
| 14 | Fri | | 5 | 6 | 07.8 | 11 | 43.6 | 17 | 19.1 | S | 1 | 23 | 15.0 | 16 | 26 | 22.6 | 3 | 7 | 12.0 |
| | | | | | | | | | | | | | | | | | (4 | 27 | 07.4) |
| 15 | Sat | | 6 | 6 | 08.4 | 11 | 43.6 | 17 | 18.6 | | 2 | 19 | 44.6 | 17 | 23 | 38.6 | 5 | 23 | 03.6 |
| 16 | Sun | | 7 | 6 | 09.0 | 11 | 43.7 | 17 | 18.1 | | 3 | 16 | 22.5 | 18 | 21 | 04.6 | 6 | 19 | 07.8 |
| 17 | Mon | | 8 | 6 | 09.6 | 11 | 43.7 | 17 | 17.7 | | 4 | 13 | 17.2 | 19 | 18 | 49.1 | 7 | 15 | 26.6 |
| 18 | Tue | | 9 | 6 | 10.2 | 11 | 43.8 | 17 | 17.2 | S | 5 | 10 | 36.2 | 20 | 16 | 59.6 | 8 | 12 | 05.8 |
| 19 | Wed | | 10 | 6 | 10.8 | 11 | 43.9 | 17 | 16.8 | | 6 | 8 | 25.6 | 21 | 15 | 41.5 | 9 | 9 | 09.8 |
| 20 | Thu | | 11 | 6 | 11.4 | 11 | 44.0 | 17 | 16.4 | | 7 | 6 | 49.9 | 22 | 14 | 58.9 | 10 | 6 | 41.9 |
| | | | | | | | | | | | (8 | 29 | 51.7) | | | | (11 | 28 | 43.6) |
| 21 | Fri | | 12 | 6 | 12.1 | 11 | 44.1 | 17 | 16.0 | | 9 | 29 | 31.6 | 23 | 14 | 53.4 | 12 | 27 | 15.3 |
| 22 | Sat | | 13 | 6 | 12.7 | 11 | 44.3 | 17 | 15.7 | S | 10 | 29 | 48.6 | 24 | 15 | 24.8 | 13 | 26 | 15.9 |
| 23 | Sun | | 14 | 6 | 13.3 | 11 | 44.4 | 17 | 15.3 | | 11 | --- | --- | 25 | 16 | 31.1 | 14 | 25 | 43.1 |
| 24 | Mon | | 15 | 6 | 14.0 | 11 | 44.6 | 17 | 15.0 | | 11 | 6 | 40.0 | 26 | 18 | 09.0 | 15 | 25 | 34.3 |
| 25 | Tue | | 16 | 6 | 14.6 | 11 | 44.8 | 17 | 14.7 | | 12 | 8 | 02.1 | 27 | 20 | 14.4 | 16 | 25 | 46.2 |
| 26 | Wed | | 17 | 6 | 15.3 | 11 | 44.9 | 17 | 14.5 | | 13 | 9 | 50.6 | 1 | 22 | 42.8 | 17 | 26 | 15.3 |
| 27 | Thu | | 18 | 6 | 16.0 | 11 | 45.1 | 17 | 14.2 | | 14 | 12 | 00.7 | 2 | 25 | 29.4 | 18 | 26 | 58.1 |
| 28 | Fri | | 19 | 6 | 16.6 | 11 | 45.4 | 17 | 14.0 | S | 15 | 14 | 27.5 | 3 | 28 | 29.0 | 19 | 27 | 50.9 |
| 29 | Sat | | 20 | 6 | 17.3 | 11 | 45.6 | 17 | 13.8 | K | 1 | 17 | 05.3 | 4 | --- | --- | 20 | 28 | 49.5 |
| 30 | Sun | | 21 | 6 | 18.0 | 11 | 45.8 | 17 | 13.6 | K | 2 | 19 | 47.7 | 4 | 7 | 35.9 | 21 | 29 | 49.1 |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

Dakshinayana
Dakshina Gola

SAKA ERA 1943
Month of KARTIKA (30 days)

Ayanamsa on 1st : 24°09′26″

(*Nirayana*) 8 Kartika, 5122 Kali Era to (*Nirayana*) 7 Agrahayana, 5122 Kali Era

| Date | Gregorian Date | Solar Month | Lunar Month | Transit of the Sun | Phenomena | Festivals |
|---|---|---|---|---|---|---|
| | 2021 A.D. | | | | | |
| 1 | Oct. 23 | SAURA KARTIKA | CHANDRA ASVINA | 1- Sun enters Tropical Scorpio ($10^h21^m.1$) | | |
| 2 | 24 | | | 2- Sun enters Svati nak. ($6^h 12^m.9$) | | 2- Karaka Chaturthi, Dasaratha Chaturthi. |
| 3 | 25 | | | | | |
| 4 | 26 | | | | | |
| 5 | 27 | | | | | |
| 6 | 28 | | | | | 6- Ahoyi Astami, Karashtami, Ahoyi Astami (Punjab). |
| 7 | 29 | | | | | |
| 8 | 30 | | | | 8- Sayana Vaidhriti ($10^h39^m.3$) | |
| 9 | 31 | | | | | |
| 10 | Nov. 1 | | | | | 10- Govatsa Dvadasi, Martyrdom day of Bhagat Kanwar Ram (Sindhi), Rama Ekadasi. |
| 11 | 2 | | | | | 11- Dhana Trayodasi. |
| 12 | 3 | | | | | 12- Kali Chaturdasi, Dipavali(S.India). |
| 13 | 4 | | | | 13- New Moon ($26^h 44^m.6$) | 13- Dipavali, Kali Puja, Lakshmi Puja, Kaumudi Dipam, Lakshmi Dipam, Kedar Gauri Vrata (S. India), Mahavira Nirvana(Jain), Naraka Chaturdasi (Purvarunodaya). |
| 14 | 5 | | CHANDRA KARTIKA | | | 14- Kartika Sukladi, Govardhana Puja, Bali Puja, Annakuta. |
| 15 | 6 | | | 15- Sun enters Visakha nak. ($14^h 20^m.1$) | | 15- Yama Dvitiya, Bhratri Dvitiya (Bengal), Visvakarma Day, Dwat Puja (Bihar). |
| 16 | 7 | | | | | |
| 17 | 8 | | | | | |
| 18 | 9 | | | | | 18- Jnana Panchami (Jain). |
| 19 | 10 | | | | 19- Sayana Vyatipata ($28^h01^m.8$) | 19- Pratihara Shashthi or Surya Shashthi (Chhat -Bihar). |
| 20 | 11 | | | | | 20- Trivandrum Arat (Kerala), Gopashtami or Gosthashtami. |
| 21 | 12 | | | | | 21- Jagaddhatri Puja, Akshaya Navami. |
| 22 | 13 | | | | | |
| 23 | 14 | | | | | 23- Children's Day (Nehru's Birthday). |
| 24 | 15 | | | 24- Saura Margasirshadi ($15^h 24^m.6$) | | 24- Utthana or Deva Prabodhani Ekadasi, Tulasi Vivaha. |
| 25 | 16 | | | | | 25- Kartika Puja. |
| 26 | 17 | SAURA MARGASIRSHA | | | | 26- Vaikuntha Chaturdasi (Pradosa), Death Anniversary of Lala Lajpat Rai, Vaikuntha Chaturdasi. |
| 27 | 18 | | | | | 27- Bharani Dipam, Rasayatra (Samarta), Tripurotsava. |
| 28 | 19 | | | 28- Sun enters Anuradha nak. ($20^h24^m.8$) | 28- Mars rises in the East ($6^h 18^m$) 28- Full Moon ($14^h27^m.5$) 28- Partial Lunar Eclipse (visible in India) | 28- Rasayatra (Vaishnava), Kartiki Purnima, Rathayatra(Jain), Guru Nanak's Birthday, Puskar Fair (Ajmer), Huthri-3 Days (Coorg), Krittika Dipam. |
| 29 | 20 | | | | 29- Jupiter enters into Kumbha ($23^h30^m.4$) | 29- Birthday celebration of Prof.Ram Panjwani (Sindhi). |
| 30 | Nov. 21 | | | | | |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters : Mithuna 3, $14^h36^m.7$; Karkata 5, $27^h 05^m.8$; Simha 8, $12^h 51^m.5$; Kanya 10, $18^h 39^m.3$; Tula 12, $20^h 53^m.2$; Vrischika 14, $21^h 04^m.1$; Dhanus 16, $21^h04^m.6$; Makara 18, $22^h 36^m.9$; Kumbha 20, $26^h 51^m.5$; Mina 23, $10^h 11^m.3$; Mesha 25, $20^h 14^m.4$; Vrisha 28, $8^h 13^m.2$; Mithuna 30, $21^h 10^m.1$ Sun enters :- Nirayana Vrischika 25, $13^h 03^m.0$.

# INDIAN CALENDAR

SAKA ERA 1943

Dhanus : Sahasya
Hemanta, 2nd Month

Month of AGRAHAYANA (30 days)

(*Nirayana*) 8 Agrahayana, 5122 Kali Era to (*Nirayana)* 7 Pausha, 5122 Kali Era

| Date | Week Day | Gregorian Date | | Sunrise | | Apparent Noon | | Sunset | | Tithi | | | | Nakshatra | | | Yoga | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | No. | | Ending Moment | | No. | Ending Moment | | No. | Ending Moment | |
| | | | | h | m | h | m | h | m | | | h | m | | h | m | | h | m |
| | | 2021 A.D. | | | | | | | | | | | | | | | | | |
| 1 | Mon | Nov. | 22 | 6 | 18.6 | 11 | 46.1 | 17 | 13.5 | K | 3 | 22 | 27.5 | 5 | 10 | 43.5 | 22 | ---- | ---- |
| 2 | Tue | | 23 | 6 | 19.3 | 11 | 46.4 | 17 | 13.3 | | 4 | 24 | 56.1 | 6 | 13 | 44.1 | 22 | 6 | 44.4 |
| 3 | Wed | | 24 | 6 | 20.0 | 11 | 46.7 | 17 | 13.2 | K | 5 | 27 | 04.2 | 7 | 16 | 29.1 | 23 | 7 | 29.2 |
| 4 | Thu | | 25 | 6 | 20.7 | 11 | 46.9 | 17 | 13.2 | | 6 | 28 | 42.7 | 8 | 18 | 49.3 | 24 | 7 | 56.9 |
| 5 | Fri | | 26 | 6 | 21.4 | 11 | 47.3 | 17 | 13.1 | | 7 | 29 | 43.4 | 9 | 20 | 36.3 | 25 | 8 | 01.1 |
| 6 | Sat | | 27 | 6 | 22.1 | 11 | 47.6 | 17 | 13.1 | | 8 | 30 | 00.5 | 10 | 21 | 43.1 | 26 | 7 | 35.9 |
| 7 | Sun | | 28 | 6 | 22.7 | 11 | 47.9 | 17 | 13.1 | | 9 | 29 | 30.8 | 11 | 22 | 05.3 | 27 | 6 | 37.0 |
| | | | | | | | | | | | | | | | | | (1 | 29 | 01.6) |
| 8 | Mon | | 29 | 6 | 23.4 | 11 | 48.3 | 17 | 13.1 | K | 10 | 28 | 14.3 | 12 | 21 | 41.7 | 2 | 26 | 49.4 |
| 9 | Tue | | 30 | 6 | 24.1 | 11 | 48.6 | 17 | 13.1 | | 11 | 26 | 14.1 | 13 | 20 | 33.9 | 3 | 24 | 02.1 |
| 10 | Wed | Dec. | 1 | 6 | 24.8 | 11 | 49.0 | 17 | 13.2 | | 12 | 23 | 35.8 | 14 | 18 | 46.8 | 4 | 20 | 43.5 |
| 11 | Thu | | 2 | 6 | 25.5 | 11 | 49.4 | 17 | 13.3 | | 13 | 20 | 26.8 | 15 | 16 | 27.4 | 5 | 16 | 59.0 |
| 12 | Fri | | 3 | 6 | 26.2 | 11 | 49.8 | 17 | 13.4 | | 14 | 16 | 56.0 | 16 | 13 | 44.3 | 6 | 12 | 55.4 |
| 13 | Sat | | 4 | 6 | 26.8 | 11 | 50.2 | 17 | 13.6 | K | 30 | 13 | 13.0 | 17 | 10 | 47.4 | 7 | 8 | 39.9 |
| | | | | | | | | | | | | | | | | | (8 | 28 | 20.8) |
| 14 | Sun | | 5 | 6 | 27.5 | 11 | 50.6 | 17 | 13.7 | S | 1 | 9 | 27.9 | 18 | 7 | 47.1 | 9 | 24 | 06.3 |
| | | | | | | | | | | | (2 | 29 | 50.9) | (19 | 28 | 54.1) | | | |
| 15 | Mon | | 6 | 6 | 28.2 | 11 | 51.0 | 17 | 13.9 | | 3 | 26 | 32.2 | 20 | 26 | 19.0 | 10 | 20 | 04.5 |
| 16 | Tue | | 7 | 6 | 28.8 | 11 | 51.4 | 17 | 14.1 | | 4 | 23 | 41.3 | 21 | 24 | 11.5 | 11 | 16 | 23.0 |
| 17 | Wed | | 8 | 6 | 29.5 | 11 | 51.9 | 17 | 14.4 | S | 5 | 21 | 26.6 | 22 | 22 | 39.9 | 12 | 13 | 08.7 |
| 18 | Thu | | 9 | 6 | 30.1 | 11 | 52.3 | 17 | 14.6 | | 6 | 19 | 54.6 | 23 | 21 | 50.9 | 13 | 10 | 26.9 |
| 19 | Fri | | 10 | 6 | 30.8 | 11 | 52.8 | 17 | 14.9 | | 7 | 19 | 09.8 | 24 | 21 | 48.0 | 14 | 8 | 21.3 |
| 20 | Sat | | 11 | 6 | 31.4 | 11 | 53.2 | 17 | 15.2 | | 8 | 19 | 13.4 | 25 | 22 | 32.0 | 15 | 6 | 53.5 |
| | | | | | | | | | | | | | | | | | (16 | 30 | 02.4) |
| 21 | Sun | | 12 | 6 | 32.0 | 11 | 53.7 | 17 | 15.5 | | 9 | 20 | 03.0 | 26 | 23 | 59.7 | 17 | 29 | 44.9 |
| 22 | Mon | | 13 | 6 | 32.6 | 11 | 54.1 | 17 | 15.8 | S | 10 | 21 | 33.3 | 27 | 26 | 05.2 | 18 | 29 | 55.8 |
| 23 | Tue | | 14 | 6 | 33.2 | 11 | 54.6 | 17 | 16.2 | | 11 | 23 | 36.1 | 1 | 28 | 40.0 | 19 | 30 | 28.6 |
| 24 | Wed | | 15 | 6 | 33.8 | 11 | 55.1 | 17 | 16.6 | | 12 | 26 | 02.0 | 2 | --- | --- | 20 | --- | --- |
| 25 | Thu | | 16 | 6 | 34.4 | 11 | 55.6 | 17 | 17.0 | | 13 | 28 | 41.2 | 2 | 7 | 34.9 | 20 | 7 | 16.6 |
| 26 | Fri | | 17 | 6 | 34.9 | 11 | 56.1 | 17 | 17.4 | | 14 | --- | --- | 3 | 10 | 40.4 | 21 | 8 | 13.0 |
| 27 | Sat | | 18 | 6 | 35.5 | 11 | 56.6 | 17 | 17.8 | | 14 | 7 | 24.8 | 4 | 13 | 48.5 | 22 | 9 | 11.9 |
| 28 | Sun | | 19 | 6 | 36.0 | 11 | 57.0 | 17 | 18.3 | S | 15 | 10 | 05.5 | 5 | 16 | 52.2 | 23 | 10 | 08.2 |
| 29 | Mon | | 20 | 6 | 36.5 | 11 | 57.5 | 17 | 18.7 | K | 1 | 12 | 37.0 | 6 | 19 | 46.0 | 24 | 10 | 57.7 |
| 30 | Tue | | 21 | 6 | 37.1 | 11 | 58.0 | 17 | 19.2 | K | 2 | 14 | 54.3 | 7 | 22 | 25.0 | 25 | 11 | 36.9 |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

Dakshinayana — SAKA ERA 1943

Dakshina Gola — Month of AGRAHAYANA (30 days) — Ayanamsa on 1st : 24°09′30″

(*Nirayana*) 8 Agrahayana, 5122 Kali Era to (*Nirayana*) 7 Pausha, 5122 Kali Era

| Date | Gregorian Date | Solar Month | Lunar Month | Transit of the Sun | Phenomena | Festivals |
|---|---|---|---|---|---|---|
| | 2021 A.D. | | | | | |
| 1 | Nov. 22 | SAURA MARGASIRSHA | CHANDRA KARTIKA | 1- Sun enters Trop. Saggitarius ($8^h 03^m.7$) | | |
| 2 | 23 | | | | | |
| 3 | 24 | | | | 3- Sayana Vaidhriti ($16^h 41^m.0$) | 3- Guru Tegh Bahadur's Martyrdom Day. |
| 4 | 25 | | | | | |
| 5 | 26 | | | | | |
| 6 | 27 | | | | | 6- Kalashtami, Prathamashtami (Odisha), Vaikkatastami (Kerala). |
| 7 | 28 | | | | | |
| 8 | 29 | | | | | |
| 9 | 30 | | | | | 9- Utpanna Ekadasi. |
| 10 | Dec. 1 | | | | | |
| 11 | 2 | | | 11- Sun enters Jyeshtha nak. ($24^h 45^m.0$) | | |
| 12 | 3 | | | | | |
| 13 | 4 | | | | 13- New Moon ($13^h 13^m.0$) 13- Total Solar Eclipse (Not visible in India) | |
| 14 | 5 | | CHANDRA MARGASIRSHA | | | |
| 15 | 6 | | | | 15- Sayana Vyatipata ($17^h 39^m.2$) | |
| 16 | 7 | | | | | |
| 17 | 8 | | | | | |
| 18 | 9 | | | | | 18-Guha Shashthi, Subrahmanya Shashthi (S. India), Champa Shashthi(Maharashtra), Mulakrupini Shashthi (Bengal). |
| 19 | 10 | | | | | 19- Mitra Saptami. |
| 20 | 11 | | | | | |
| 21 | 12 | | | | | |
| 22 | 13 | | | | | |
| 23 | 14 | | | 23- Saura Paushadi ($30^h 16^m.4$) | | 23- Mokshada Ekadasi, Mauna Ekadasi (Jain), Gita Jayanti. |
| 24 | 15 | | | 24- Sun enters Mula nak.($27^h 44^m.3$) | | 24-Akhanda Dvadasi. |
| 25 | 16 | SAURA PAUSHA | | | | |
| 26 | 17 | | | | | |
| 27 | 18 | | | | | 27- Shri Dutta Jayanti(Maharashtra), Dattatreya Jayanti. |
| 28 | 19 | | | | 28- Sayana Vaidhriti ($19^h 28^m.1$) 28- Full Moon ($10^h 05^m.5$) | 28- Margi Purnima. |
| 29 | 20 | | | | | 29- Arudra Darsanam (Purvarunodaya) (S.India). |
| 30 | Dec. 21 | | | 30- Sun enters Tropical Capricorn ($21^h 29^m.3$) | | |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Karkata 3, $9^h 49^m.8$; Simha 5, $20^h 36^m.3$; Kanya 7, $28^h 03^m.7$; Tula 10, $7^h 44^m.9$; Vrischika 12, $8^h 26^m.8$; Dhanus 14, $7^h 47^m.1$; Makara 16, $7^h 44^m.1$; Kumbha 18, $10^h 09^m.7$; Mina 20, $16^h 16^m.7$; Mesha 22, $26^h 05^m.2$; Vrisha 25, $14^h 20^m.5$; Mithuna 27, $27^h 21^m.2$; Karkata 30, $15^h 46^m.9$

Sun enters :- Nirayana Dhanus 24, $27^h 44^m.3$.

# INDIAN CALENDAR

SAKA ERA 1943

Makara : Tapas

Month of PAUSHA (30 days)

Winter (Sisira), 1st Month

(*Nirayana*) 8 Pausha, 5122 Kali Era to (*Nirayana)* 7 Magha, 5122 Kali Era

| Date | Week Day | Gregorian Date | Sunrise | | Apparent Noon | | Sunset | | Tithi | | | Nakshatra | | | Yoga | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | No. | Ending Moment | | No. | Ending Moment | | No. | Ending Moment | |
| | | | h | m | h | m | h | m | | h | m | | h | m | | h | m |
| | | 2021 A.D. | | | | | | | | | | | | | | | |
| 1 | Wed | Dec. 22 | 6 | 37.6 | 11 | 58.5 | 17 | 19.7 | K 3 | 16 | 52.7 | 8 | 24 | 44.9 | 26 | 12 | 02.4 |
| 2 | Thu | 23 | 6 | 38.0 | 11 | 59.0 | 17 | 20.3 | 4 | 18 | 27.8 | 9 | 26 | 41.3 | 27 | 12 | 11.1 |
| 3 | Fri | 24 | 6 | 38.5 | 11 | 59.5 | 17 | 20.8 | K 5 | 19 | 34.9 | 10 | 28 | 09.5 | 1 | 11 | 59.7 |
| 4 | Sat | 25 | 6 | 38.9 | 12 | 00.0 | 17 | 21.3 | 6 | 20 | 09.8 | 11 | 29 | 05.4 | 2 | 11 | 24.7 |
| 5 | Sun | 26 | 6 | 39.4 | 12 | 00.5 | 17 | 21.9 | 7 | 20 | 08.7 | 12 | 29 | 25.5 | 3 | 10 | 23.1 |
| 6 | Mon | 27 | 6 | 39.8 | 12 | 01.0 | 17 | 22.5 | 8 | 19 | 28.9 | 13 | 29 | 07.4 | 4 | 8 | 52.3 |
| 7 | Tue | 28 | 6 | 40.2 | 12 | 01.5 | 17 | 23.1 | 9 | 18 | 09.8 | 14 | 28 | 11.0 | 5 | 6 | 50.9 |
| | | | | | | | | | | | | | | | (6 | 28 | 18.6) |
| 8 | Wed | 29 | 6 | 40.5 | 12 | 02.0 | 17 | 23.7 | K 10 | 16 | 12.6 | 15 | 26 | 38.4 | 7 | 25 | 16.8 |
| 9 | Thu | 30 | 6 | 40.9 | 12 | 02.5 | 17 | 24.3 | 11 | 13 | 40.8 | 16 | 24 | 33.9 | 8 | 21 | 48.8 |
| 10 | Fri | 31 | 6 | 41.2 | 12 | 03.0 | 17 | 24.9 | 12 | 10 | 40.0 | 17 | 22 | 04.2 | 9 | 17 | 59.3 |
| | | 2022 A.D. | | | | | | | | | | | | | | | |
| 11 | Sat | Jan. 1 | 6 | 41.6 | 12 | 03.4 | 17 | 25.6 | 13 | 7 | 17.5 | 18 | 19 | 17.4 | 10 | 13 | 54.5 |
| | | | | | | | | | (14 | 27 | 42.1) | | | | | | |
| 12 | Sun | 2 | 6 | 41.9 | 12 | 03.9 | 17 | 26.2 | K 30 | 24 | 03.5 | 19 | 16 | 23.4 | 11 | 9 | 41.7 |
| | | | | | | | | | | | | | | | (12 | 29 | 28.6) |
| 13 | Mon | 3 | 6 | 42.1 | 12 | 04.4 | 17 | 26.9 | S 1 | 20 | 32.4 | 20 | 13 | 32.8 | 13 | 25 | 24.1 |
| 14 | Tue | 4 | 6 | 42.4 | 12 | 04.8 | 17 | 27.6 | 2 | 17 | 19.5 | 21 | 10 | 56.7 | 14 | 21 | 36.6 |
| 15 | Wed | 5 | 6 | 42.6 | 12 | 05.3 | 17 | 28.2 | 3 | 14 | 35.4 | 22 | 8 | 46.1 | 15 | 18 | 14.2 |
| 16 | Thu | 6 | 6 | 42.8 | 12 | 05.7 | 17 | 28.9 | 4 | 12 | 29.8 | 23 | 7 | 11.2 | 16 | 15 | 23.9 |
| | | | | | | | | | | | | (24 | 30 | 20.6) | | | |
| 17 | Fri | 7 | 6 | 43.0 | 12 | 06.2 | 17 | 29.6 | S 5 | 11 | 10.8 | 25 | 30 | 19.6 | 17 | 13 | 11.3 |
| 18 | Sat | 8 | 6 | 43.2 | 12 | 06.6 | 17 | 30.3 | 6 | 10 | 43.5 | 26 | --- | --- | 18 | 11 | 39.5 |
| 19 | Sun | 9 | 6 | 43.3 | 12 | 07.0 | 17 | 31.0 | 7 | 11 | 09.3 | 26 | 7 | 10.2 | 19 | 10 | 48.6 |
| 20 | Mon | 10 | 6 | 43.4 | 12 | 07.4 | 17 | 31.7 | 8 | 12 | 24.9 | 27 | 8 | 49.4 | 20 | 10 | 35.7 |
| 21 | Tue | 11 | 6 | 43.5 | 12 | 07.8 | 17 | 32.4 | 9 | 14 | 22.2 | 1 | 11 | 09.7 | 21 | 10 | 54.6 |
| 22 | Wed | 12 | 6 | 43.6 | 12 | 08.2 | 17 | 33.1 | S 10 | 16 | 49.6 | 2 | 13 | 59.9 | 22 | 11 | 37.2 |
| 23 | Thu | 13 | 6 | 43.7 | 12 | 08.6 | 17 | 33.8 | 11 | 19 | 33.2 | 3 | 17 | 06.8 | 23 | 12 | 33.8 |
| 24 | Fri | 14 | 6 | 43.7 | 12 | 08.9 | 17 | 34.5 | 12 | 22 | 19.6 | 4 | 20 | 17.6 | 24 | 13 | 34.9 |
| 25 | Sat | 15 | 6 | 43.7 | 12 | 09.3 | 17 | 35.2 | 13 | 24 | 57.5 | 5 | 23 | 21.1 | 25 | 14 | 32.3 |
| 26 | Sun | 16 | 6 | 43.7 | 12 | 09.7 | 17 | 36.0 | 14 | 27 | 18.8 | 6 | 26 | 09.2 | 26 | 15 | 19.5 |
| 27 | Mon | 17 | 6 | 43.6 | 12 | 10.0 | 17 | 36.7 | S 15 | 29 | 18.4 | 7 | 28 | 37.1 | 27 | 15 | 52.2 |
| 28 | Tue | 18 | 6 | 43.5 | 12 | 10.3 | 17 | 37.4 | K 1 | --- | --- | 8 | 30 | 42.4 | 1 | 16 | 07.7 |
| 29 | Wed | 19 | 6 | 43.4 | 12 | 10.6 | 17 | 38.1 | K 1 | 6 | 54.2 | 9 | --- | --- | 2 | 16 | 05.1 |
| 30 | Thu | 20 | 6 | 43.3 | 12 | 10.9 | 17 | 38.8 | K 2 | 8 | 05.5 | 9 | 8 | 24.3 | 3 | 15 | 44.1 |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

# INDIAN CALENDAR

SAKA ERA 1943

Uttarayana

Dakshina Gola

Month of PAUSHA (30 days)

Ayanamsa on 1st : 24°09′36″

(*Nirayana*) 8 Pausha, 5122 Kali Era to (*Nirayana*) 7 Magha, 5122 Kali Era

| Date | Gregorian Date | Solar Month | Lunar Month | Transit of the Sun | Phenomena | Festivals |
|---|---|---|---|---|---|---|
| | 2021 A.D. | | | | | |
| 1 | Dec. 22 | SAURA PAUSHA | CHANDRA MARGASIRSHA | | | 1- Uttarayana day. |
| 2 | 23 | | | | | |
| 3 | 24 | | | | | |
| 4 | 25 | | | | | 4- Birthday of Sadhu T. L. Vaswani (Sindhi). |
| 5 | 26 | | | | | 5- Jor Mela- 3 days (Punjab). |
| 6 | 27 | | | | | 6- Ashtaka (Pupashtaka). |
| 7 | 28 | | | 7- Sun enters Purvashadha nak. ($30^h 02^m.5$) | | |
| 8 | 29 | | | | | 8- Birthday of Parsvanath (Jain). |
| 9 | 30 | | | | | 9- Saphala Ekadasi. |
| 10 | 31 | | | | | |
| | 2022 A.D. | | | | | |
| 11 | Jan. 1 | | | | 11- Sayana Vyatipata ($11^h 26^m.6$) | |
| 12 | 2 | | | | 12- New Moon ($24^h 03^m.5$) | 12- Vakula Amavasya (Odisha). |
| 13 | 3 | | CHANDRA PAUSHA | | | |
| 14 | 4 | | | | | |
| 15 | 5 | | | | 15- Venus sets in the West ($27^h 36^m$) | |
| 16 | 6 | | | | | |
| 17 | 7 | | | | | |
| 18 | 8 | | | | | |
| 19 | 9 | | | | | 19- Guru Govind Singh's Birthday. |
| 20 | 10 | | | | | |
| 21 | 11 | | | 21- Sun enters Uttarashadha nak. ($7^h 57^m.2$) | 21- Venus rises in the East ($14^h 00^m$) | |
| 22 | 12 | | | | | 22- Samba Dasami (Odisha). |
| 23 | 13 | | | 23- Saura Maghadi ($17^h 01^m.3$) | 23- Sayana Vaidhriti ($21^h 57^m.7$) | 23- Putrada Ekadasi, Vaikuntha Ekadasi (S.India), Lohri (Jammu & Kashmir, Punjab), Bhogi (S. India). |
| 24 | 14 | | | | | 24- Makara Samkranti (Bengal), Magha Bihu (Assam), Makara Samkranti (N.India), Pongal (S. India), Makara Snana, Tila Samkranti, Birthday of Sant Parmanand (Sindhi). |
| 25 | 15 | SAURA MAGHA | | | | 25- Mattu Pongal or Kanumu, Tai Pongal (Kerala). |
| 26 | 16 | | | | | |
| 27 | 17 | | | | 27- Full Moon ($29^h 18^m.4$) | 27- Paushi Purnima, Pushyabhisheka Yatra. |
| 28 | 18 | | | | | 28- Floating Festival /Tai Poosam. |
| 29 | 19 | | | | | |
| 30 | Jan. 20 | | | 30- Sun Enters Tropical Aquarius ($8^h 09^m.1$) | | |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Simha 2, $26^h 41^m.2$; Kanya 5, $11^h 13^m.9$; Tula 7, $16^h 43^m.8$; Vrischika 9, $19^h 07^m.7$; Dhanus 11, $19^h 17^m.4$; Makara 13, $18^h 52^m.0$; Kumbha 15, $19^h 53^m.7$; Mina 17, $24^h 15^m.1$; Mesha 20, $8^h 49^m.4$; Vrisha 22, $20^h 45^m.5$; Mithuna 25, $09^h 50^m.8$; Karkata 27, $22^h 02^m.2$; Mithuna 25, $09^h 50^m.8$; Karkata 27, $22^h 02^m.2$; Simha 30, $08^h 24^m.3$

Sun enters :- Nirayana Makara 24, $14^h 29^m.6$

SAKA ERA 1943

Kumbha : Tapasya

Month of MAGHA (30 days)

Winter (Sisira), 2nd Month

(*Nirayana*) 8 Magha, 5122 Kali Era to (*Nirayana)* 7 Phalguna, 5122 Kali Era

| Date | Week Day | Gregorian Date | | Sunrise | | Apparent Noon | | Sunset | | Tithi | | | | Nakshatra | | | Yoga | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | No. | Ending Moment | | No. | Ending Moment | | No. | Ending Moment | |
| | | | | h | m | h | m | h | m | | | h | m | | h | m | | h | m |
| | | 2022A.D. | | | | | | | | | | | | | | | | | |
| 1 | Fri | Jan. | 21 | 6 | 43.2 | 12 | 11.2 | 17 | 39.5 | K | 3 | 8 | 52.4 | 10 | 9 | 42.9 | 4 | 15 | 04.5 |
| 2 | Sat | | 22 | 6 | 43.0 | 12 | 11.5 | 17 | 40.2 | | 4 | 9 | 14.9 | 11 | 10 | 38.0 | 5 | 14 | 06.3 |
| 3 | Sun | | 23 | 6 | 42.8 | 12 | 11.7 | 17 | 40.9 | K | 5 | 9 | 12.5 | 12 | 11 | 09.1 | 6 | 12 | 48.8 |
| 4 | Mon | | 24 | 6 | 42.6 | 12 | 12.0 | 17 | 41.6 | | 6 | 8 | 44.3 | 13 | 11 | 15.0 | 7 | 11 | 11.2 |
| 5 | Tue | | 25 | 6 | 42.4 | 12 | 12.2 | 17 | 42.3 | | 7 | 7 | 49.0 | 14 | 10 | 54.5 | 8 | 9 | 12.2 |
| | | | | | | | | | | | (8 | 30 | 25.7) | | | | | | |
| 6 | Wed | | 26 | 6 | 42.2 | 12 | 12.4 | 17 | 43.0 | | 9 | 28 | 34.5 | 15 | 10 | 06.4 | 9 | 6 | 51.2 |
| | | | | | | | | | | | | | | | | | (10 | 28 | 08.0) |
| 7 | Thu | | 27 | 6 | 41.9 | 12 | 12.7 | 17 | 43.7 | K | 10 | 26 | 16.8 | 16 | 8 | 51.0 | 11 | 25 | 03.5 |
| 8 | Fri | | 28 | 6 | 41.6 | 12 | 12.9 | 17 | 44.4 | | 11 | 23 | 36.1 | 17 | 7 | 10.1 | 12 | 21 | 40.3 |
| | | | | | | | | | | | | | | (18 | 29 | 07.5) | | | |
| 9 | Sat | | 29 | 6 | 41.3 | 12 | 13.0 | 17 | 45.1 | | 12 | 20 | 37.8 | 19 | 26 | 49.1 | 13 | 18 | 02.4 |
| 10 | Sun | | 30 | 6 | 40.9 | 12 | 13.2 | 17 | 45.8 | | 13 | 17 | 29.2 | 20 | 24 | 22.6 | 14 | 14 | 15.2 |
| 11 | Mon | | 31 | 6 | 40.6 | 12 | 13.4 | 17 | 46.5 | | 14 | 14 | 18.7 | 21 | 21 | 57.5 | 15 | 10 | 25.4 |
| 12 | Tue | Feb. | 1 | 6 | 40.2 | 12 | 13.5 | 17 | 47.1 | K | 30 | 11 | 16.1 | 22 | 19 | 44.1 | 16 | 6 | 40.5 |
| | | | | | | | | | | | | | | | | | (17 | 27 | 08.7) |
| 13 | Wed | | 2 | 6 | 39.8 | 12 | 13.6 | 17 | 47.8 | S | 1 | 8 | 31.7 | 23 | 17 | 53.1 | 18 | 23 | 58.2 |
| | | | | | | | | | | | (2 | 30 | 16.0) | | | | | | |
| 14 | Thu | | 3 | 6 | 39.3 | 12 | 13.8 | 17 | 48.5 | | 3 | 28 | 38.7 | 24 | 16 | 34.6 | 19 | 21 | 16.2 |
| 15 | Fri | | 4 | 6 | 38.9 | 12 | 13.9 | 17 | 49.1 | | 4 | 27 | 47.5 | 25 | 15 | 57.8 | 20 | 19 | 09.2 |
| 16 | Sat | | 5 | 6 | 38.4 | 12 | 13.9 | 17 | 49.7 | S | 5 | 27 | 47.3 | 26 | 16 | 8.7 | 21 | 17 | 41.0 |
| 17 | Sun | | 6 | 6 | 37.9 | 12 | 14.0 | 17 | 50.4 | | 6 | 28 | 38.5 | 27 | 17 | 9.8 | 22 | 16 | 53.0 |
| 18 | Mon | | 7 | 6 | 37.4 | 12 | 14.1 | 17 | 51.0 | | 7 | 30 | 16.5 | 1 | 18 | 58.6 | 23 | 16 | 42.9 |
| 19 | Tue | | 8 | 6 | 36.9 | 12 | 14.1 | 17 | 51.6 | | 8 | --- | --- | 2 | 21 | 27.2 | 24 | 17 | 05.0 |
| 20 | Wed | | 9 | 6 | 36.3 | 12 | 14.2 | 17 | 52.2 | | 8 | 8 | 31.3 | 3 | 24 | 23.2 | 25 | 17 | 50.5 |
| 21 | Thu | | 10 | 6 | 35.8 | 12 | 14.2 | 17 | 52.9 | | 9 | 11 | 08.7 | 4 | 27 | 31.7 | 26 | 18 | 48.6 |
| 22 | Fri | | 11 | 6 | 35.2 | 12 | 14.2 | 17 | 53.5 | S | 10 | 13 | 52.6 | 5 | --- | --- | 27 | 19 | 48.4 |
| 23 | Sat | | 12 | 6 | 34.6 | 12 | 14.2 | 17 | 54.0 | | 11 | 16 | 27.8 | 5 | 6 | 37.4 | 1 | 20 | 39.6 |
| 24 | Sun | | 13 | 6 | 34.0 | 12 | 14.2 | 17 | 54.6 | | 12 | 18 | 42.4 | 6 | 9 | 27.4 | 2 | 21 | 14.4 |
| 25 | Mon | | 14 | 6 | 33.3 | 12 | 14.1 | 17 | 55.2 | | 13 | 20 | 28.7 | 7 | 11 | 52.6 | 3 | 21 | 27.7 |
| 26 | Tue | | 15 | 6 | 32.7 | 12 | 14.1 | 17 | 55.8 | | 14 | 21 | 43.3 | 8 | 13 | 48.5 | 4 | 21 | 17.2 |
| 27 | Wed | | 16 | 6 | 32.0 | 12 | 14.0 | 17 | 56.3 | S | 15 | 22 | 26.5 | 9 | 15 | 13.9 | 5 | 20 | 42.9 |
| 28 | Thu | | 17 | 6 | 31.3 | 12 | 14.0 | 17 | 56.9 | K | 1 | 22 | 40.7 | 10 | 16 | 10.6 | 6 | 19 | 46.2 |
| 29 | Fri | | 18 | 6 | 30.6 | 12 | 13.9 | 17 | 57.4 | | 2 | 22 | 29.7 | 11 | 16 | 41.9 | 7 | 18 | 29.7 |
| 30 | Sat | | 19 | 6 | 29.9 | 12 | 13.8 | 17 | 58.0 | K | 3 | 21 | 57.0 | 12 | 16 | 51.4 | 8 | 16 | 56.0 |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

Uttarayana
Dakshina Gola

SAKA ERA 1943
Month of MAGHA (30 days)

Ayanamsa on 1st : 24° 09′ 42″

(*Nirayana*) 8 Magha, 5122 Kali Era to (*Nirayana*) 7 Phalguna, 5122 Kali Era

| Date | Gregorian Date | Solar Month | Lunar Month | Transit of the Sun | Phenomena | Festivals |
|---|---|---|---|---|---|---|
| | 2022 A.D. | | | | | |
| 1 | Jan. 21 | SAURA MAGHA | CHANDRA PAUSHA | | | 1- Ganesha Sankastha Chaturthi, Martyrdom Day of Hemu Kalani. |
| 2 | 22 | | | | | |
| 3 | 23 | | | | | 3- Netaji's Birthday. |
| 4 | 24 | | | 4- Sun enters Sravana nak. ($10^h 20^m.2$) | | |
| 5 | 25 | | | | | 5- Birthday of Swami Vivekananda (according to tithi), Astaka (Mamsastaka). |
| 6 | 26 | | | | 6- Sayana Vyatipata ($25^h 28^m.2$) | 6- Republic Day. |
| 7 | 27 | | | | | |
| 8 | 28 | | | | | 8- Shattila Ekadasi, Birthday of Lala Lajpat Rai. |
| 9 | 29 | | | | | |
| 10 | 30 | | | | | 10- Meru Trayodasi (Jain), Ratanti Kalika Puja, Martyr's Day (Mahatma Gandhi Commemoration Day). |
| 11 | 31 | | | | | 11-Tai Amavasya, Makara Vavu (Kerala). |
| 12 | Feb. 1 | | | | 12- New Moon ($11^h 16^m.1$) | 12-Mauni Amavasya, Mahodaya Yoga (Vyatipata after $6^h 41^m$, Amavasya upto $11^h 16^m$). |
| 13 | 2 | | CHANDRA MAGHA | | | 13- Magha Sukladi. |
| 14 | 3 | | | | | |
| 15 | 4 | | | | | 15-Tila Chaturthi, Kunda Chaturthi, Varada Chaturthi, Ganesha Puja (Bengal). |
| 16 | 5 | | | | | 16-Sri Panchami, Saraswati Puja, Vasanta Panchami. |
| 17 | 6 | | | 17- Sun enters Dhanishtha nak. ($13^h 24^m.1$) | | |
| 18 | 7 | | | | | 18- Ratha Saptami (Purvarunodaya), Vidhana Saptami, Arogya Saptami. |
| 19 | 8 | | | | | 19- Bhismashtami. |
| 20 | 9 | | | | | |
| 21 | 10 | | | | | |
| 22 | 11 | | | 22- Saura Phalgunadi ($29^h 48^m.0$) | 22- Sayana Vaidhriti ($25^h 50^m.9$) | |
| 23 | 12 | | | | | 23- Jaya Ekadasi, Bhaimi Ekadasi (Bengal). |
| 24 | 13 | SAURA PHALGUNA | | | | 24- Bhishma Dvadasi. |
| 25 | 14 | | | | | 25- Desert Festival- 3 days (Jaisalmer). |
| 26 | 15 | | | | | |
| 27 | 16 | | | | 27- Full Moon ($22^h 26^m.5$) | 27- Maghi Purnima, Guru Ravi Das's Birthday. |
| 28 | 17 | | | | | 28- Masi Magham. |
| 29 | 18 | | | 29- Sun enters Trop. Pisces ($22^h 13^m.0$) | | |
| 30 | Feb. 19 | | | 30- Sun enters Satabhisaj nak. ($17^h 57^m.4$) | | 30- Sivaji Jayanti. |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Moon enters :- Kanya 2, $16^h 48^m.1$; Tula 4, $23^h 08^m.1$; Vrischika 6, $27^h 12^m.4$; Dhanus 8, $29^h 07^m.5$; Makara 10, $29^h 45^m.8$; Kumbha 13, $6^h 45^m.0$; Mina 15, $10^h 02^m.6$; Mesha 17, $17^h 09^m.8$; Vrisha 19, $28^h 09^m.2$; Mithuna 22, $17^h 05^m.7$; Karkata 24, $29^h 19^m.0$; Simha 27, $15^h 13^m.8$; Kanya 29, $22^h 46^m.1$; Sun enters :- Nirayana Kumbha 23, $27^h 27^m.6$.

# INDIAN CALENDAR

SAKA ERA 1943

Mina : Madhu
Spring (Vasanta), 1st Month

Month of PHALGUNA (30 days)

(*Nirayana*) 8 Phalguna, 5122 Kali Era to (*Nirayana)* 7 Chaitra, 5122 Kali Era

| Date | Week Day | Gregorian Date | | Sunrise | | Apparent Noon | | Sunset | | Tithi | | | | Nakshatra | | | Yoga | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | No. | Ending Moment | | No. | Ending Moment | | No. | Ending Moment | |
| | | | | h | m | h | m | h | m | | | h | m | | h | m | | h | m |
| | | 2022A.D. | | | | | | | | | | | | | | | | | |
| 1 | Sun | Feb. | 20 | 6 | 29.2 | 12 | 13.7 | 17 | 58.5 | K | 4 | 21 | 05.8 | 13 | 16 | 42.2 | 9 | 15 | 07.4 |
| 2 | Mon | | 21 | 6 | 28.4 | 12 | 13.6 | 17 | 59.0 | | 5 | 19 | 58.0 | 14 | 16 | 16.7 | 10 | 13 | 05.4 |
| 3 | Tue | | 22 | 6 | 27.6 | 12 | 13.5 | 17 | 59.5 | | 6 | 18 | 35.0 | 15 | 15 | 36.0 | 11 | 10 | 51.2 |
| 4 | Wed | | 23 | 6 | 26.9 | 12 | 13.3 | 18 | 00.0 | | 7 | 16 | 56.9 | 16 | 14 | 40.6 | 12 | 8 | 25.1 |
| | | | | | | | | | | | | | | | | | (13 | 29 | 47.3) |
| 5 | Thu | | 24 | 6 | 26.1 | 12 | 13.2 | 18 | 00.5 | | 8 | 15 | 04.3 | 17 | 13 | 30.8 | 14 | 26 | 58.1 |
| 6 | Fri | | 25 | 6 | 25.3 | 12 | 13.0 | 18 | 01.0 | | 9 | 12 | 57.9 | 18 | 12 | 07.3 | 15 | 23 | 58.6 |
| 7 | Sat | | 26 | 6 | 24.5 | 12 | 12.9 | 18 | 01.5 | K | 10 | 10 | 39.7 | 19 | 10 | 32.1 | 16 | 20 | 50.7 |
| 8 | Sun | | 27 | 6 | 23.6 | 12 | 12.7 | 18 | 02.0 | | 11 | 8 | 13.1 | 20 | 8 | 48.6 | 17 | 17 | 38.0 |
| | | | | | | | | | | | (12 | 29 | 43.2) | | | | | | |
| 9 | Mon | | 28 | 6 | 22.8 | 12 | 12.5 | 18 | 02.5 | | 13 | 27 | 16.5 | 21 | 7 | 02.0 | 18 | 14 | 24.8 |
| | | | | | | | | | | | | | | (22 | 29 | 19.0) | | | |
| 10 | Tue | Mar. | 1 | 6 | 22.0 | 12 | 12.3 | 18 | 02.9 | | 14 | 25 | 00.8 | 23 | 27 | 47.9 | 19 | 11 | 16.7 |
| 11 | Wed | | 2 | 6 | 21.1 | 12 | 12.2 | 18 | 03.4 | K | 30 | 23 | 04.8 | 24 | 26 | 37.3 | 20 | 8 | 20.1 |
| | | | | | | | | | | | | | | | | | (21 | 29 | 41.7) |
| 12 | Thu | | 3 | 6 | 20.2 | 12 | 11.9 | 18 | 03.9 | S | 1 | 21 | 37.1 | 25 | 25 | 56.0 | 22 | 27 | 28.0 |
| 13 | Fri | | 4 | 6 | 19.4 | 12 | 11.7 | 18 | 04.3 | | 2 | 20 | 45.6 | 26 | 25 | 51.5 | 23 | 25 | 44.4 |
| 14 | Sat | | 5 | 6 | 18.5 | 12 | 11.5 | 18 | 04.8 | | 3 | 20 | 36.4 | 27 | 26 | 29.1 | 24 | 24 | 34.7 |
| 15 | Sun | | 6 | 6 | 17.6 | 12 | 11.3 | 18 | 05.2 | | 4 | 21 | 12.6 | 1 | 27 | 50.9 | 25 | 24 | 00.3 |
| 16 | Mon | | 7 | 6 | 16.7 | 12 | 11.1 | 18 | 05.6 | S | 5 | 22 | 33.0 | 2 | 29 | 54.1 | 26 | 23 | 59.5 |
| 17 | Tue | | 8 | 6 | 15.8 | 12 | 10.8 | 18 | 06.1 | | 6 | 24 | 31.6 | 3 | --- | --- | 27 | 24 | 27.2 |
| 18 | Wed | | 9 | 6 | 14.9 | 12 | 10.6 | 18 | 06.5 | | 7 | 26 | 57.1 | 3 | 8 | 31.2 | 1 | 25 | 15.3 |
| 19 | Thu | | 10 | 6 | 13.9 | 12 | 10.3 | 18 | 06.9 | | 8 | 29 | 34.7 | 4 | 11 | 30.0 | 2 | 26 | 13.2 |
| 20 | Fri | | 11 | 6 | 13.0 | 12 | 10.1 | 18 | 07.3 | | 9 | --- | --- | 5 | 14 | 35.3 | 3 | 27 | 09.7 |
| 21 | Sat | | 12 | 6 | 12.1 | 12 | 09.8 | 18 | 07.7 | | 9 | 8 | 08.0 | 6 | 17 | 31.7 | 4 | 27 | 53.9 |
| 22 | Sun | | 13 | 6 | 11.1 | 12 | 09.5 | 18 | 08.1 | S | 10 | 10 | 22.2 | 7 | 20 | 05.7 | 5 | 28 | 17.2 |
| 23 | Mon | | 14 | 6 | 10.2 | 12 | 09.2 | 18 | 08.5 | | 11 | 12 | 05.9 | 8 | 22 | 07.7 | 6 | 28 | 13.7 |
| 24 | Tue | | 15 | 6 | 09.2 | 12 | 09.0 | 18 | 08.9 | | 12 | 13 | 12.5 | 9 | 23 | 32.9 | 7 | 27 | 40.4 |
| 25 | Wed | | 16 | 6 | 08.3 | 12 | 08.7 | 18 | 09.3 | | 13 | 13 | 40.0 | 10 | 24 | 20.7 | 8 | 26 | 37.6 |
| 26 | Thu | | 17 | 6 | 07.3 | 12 | 08.4 | 18 | 09.7 | | 14 | 13 | 30.2 | 11 | 24 | 33.9 | 9 | 25 | 07.4 |
| 27 | Fri | | 18 | 6 | 06.3 | 12 | 08.1 | 18 | 10.1 | S | 15 | 12 | 47.6 | 12 | 24 | 17.6 | 10 | 23 | 13.5 |
| 28 | Sat | | 19 | 6 | 05.4 | 12 | 07.8 | 18 | 10.5 | K | 1 | 11 | 37.7 | 13 | 23 | 37.7 | 11 | 21 | 00.4 |
| 29 | Sun | | 20 | 6 | 04.4 | 12 | 07.5 | 18 | 10.9 | | 2 | 10 | 06.9 | 14 | 22 | 40.2 | 12 | 18 | 32.5 |
| 30 | Mon | | 21 | 6 | 03.4 | 12 | 07.2 | 18 | 11.2 | K | 3 | 8 | 20.8 | 15 | 21 | 30.7 | 13 | 15 | 54.1 |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

Uttarayana
Dakshina Gola

SAKA ERA 1943

Month of PHALGUNA (30 days)

Ayanamsa on 1st : $24^{0}09^{\prime}46^{\prime\prime}$

(*Nirayana*) 8 Phalguna, 5122 Kali Era to (*Nirayana*) 7 Chaitra, 5122 Kali Era

| Date | Gregorian Date | Solar Month | Lunar Month | Transit of the Sun | Phenomena | Festivals |
|---|---|---|---|---|---|---|
| | 2022 A.D. | | | | | |
| 1 | Feb. 20 | SAURA PHALGUNA | CHANDRA MAGHA | | | |
| 2 | 21 | | | | 2- Sayana Vyatipata ($10^{h}\ 21^{m}.2$) | |
| 3 | 22 | | | | 3- Jupiter sets in the west ($15^{h}\ 48^{m}$) | |
| 4 | 23 | | | | | |
| 5 | 24 | | | | | 5- Astaka (Sakastaka), Janaki Janma, Vaikkatastami (Kerala). |
| 6 | 25 | | | | | |
| 7 | 26 | | | | | 7- Vijaya Ekadasi(Smarta), Birthday of Swami Dayananda Saraswati (Founder of Arya Samaj). |
| 8 | 27 | | | | | 8- Vijaya Ekadasi(Vaishnava & Vidhava), Trisprisha Mahadvadasi. |
| 9 | 28 | | | | | 9- Maha Shivratri (Kashmir). |
| 10 | Mar. 1 | | | | | 10- Maha Shivratri, Maha Shivratri (S. India). |
| 11 | 2 | | | | 11- New Moon ($23^{h}\ 04^{m}.8$) | |
| 12 | 3 | | CHANDRA PHALGUNA | | | |
| 13 | 4 | | | 13- Sun enters Purva Bhadrapada nak. ($24^{h}\ 11^{m}.5$) | | 13- Birthday of Sri Ramakrishna Paramahamsa Deva (according to tithi). |
| 14 | 5 | | | | 14- Sayana Vaidhriti ($10^{h}\ 19^{m}.1$) | |
| 15 | 6 | | | | | |
| 16 | 7 | | | | | |
| 17 | 8 | | | | | |
| 18 | 9 | | | | | |
| 19 | 10 | | | | | 19- Holastaka. |
| 20 | 11 | | | | | |
| 21 | 12 | | | | | |
| 22 | 13 | | | 22- Saura Chaitradi ($26^{h}\ 17^{m}.0$) | | |
| 23 | 14 | | | | | 23- Amlaki Ekadasi, Govinda Dvadasi (Dvadasi after $12^{h}\ 06^{m}$) |
| 24 | 15 | SAURA CHAITRA | | | | |
| 25 | 16 | | | | | |
| 26 | 17 | | | | | 26 - Holikadahana. |
| 27 | 18 | | | 27-Sun enters Uttara Bhadrapada nak. ($8^{h}\ 37^{m}.2$) | 27- Sayana Vyatipata ($20^{h}\ 26^{m}.8$) | 27- Holi, Dolyatra, Birthday of Sri Chaitanya, Panguni Uttiram. |
| 28 | 19 | | | | | 28- Hola, Vasantotsava. |
| 29 | 20 | | | 29-Sun enters Trop. Aries ($21^{h}\ 03^{m}.4$) | 27- Full Moon ($12^{h}\ 47^{m}.6$) | 29- Maha Vishuva Day. |
| 30 | Mar. 21 | | | | | 30- Indian Year Ending day. |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of $82\frac{1}{2}^{0}$E. Long.

Moon enters :- Tula 1, $28^{h}\ 31^{m}.4$; Vrischika 4, $8^{h}\ 55^{m}.8$; Dhanus 6, $12^{h}\ 07^{m}.3$; Makara 8, $14^{h}\ 21^{m}.9$; Kumbha 10, $16^{h}\ 31^{m}.4$; Mina 12, $20^{h}\ 03^{m}.2$; Mesha 14, $26^{h}\ 29^{m}.1$; Vrisha 17, $12^{h}\ 30^{m}.6$; Mithuna 19, $25^{h}\ 02^{m}.8$; Karkata 22, $13^{h}\ 29^{m}.9$; Simha 24, $23^{h}\ 32^{m}.8$; Kanya 27, $6^{h}\ 32^{m}.4$; Tula 29, $11^{h}\ 10^{m}.8$; Sun enters: Nirayana Mina 23, $24^{h}\ 16^{m}.4$.

## PRINCIPAL FESTIVALS AND ANNIVERSARIES FOR HOLIDAYS

| Festivals | Criterion | Date |
|---|---|---|
| | | **National / Nirayana / Gregorian** |
| | | **Saka 1942 / Kali 5121 / 2021 A.D** |
| 64. Bhogi (S.India) | Day before Pongal | Pausha 23 / Pausha 30 / Jan.13 |
| 65. Makara Samkranti (Bengal), | Saura Maghadi (Midnight Rule) | Pausha 24 / Magha 1 / Jan 14 |
| Magha Bihu (Assam) | -do- | Pausha 24 / Magha 1 / Jan. 14 |
| 66. Pongal(S.India), Tai Pongal(Kerala), | The day of Saura Maghadi | Pausha 24 / Magha 1 / Jan. 14 |
| Tila Samkranti, | The day of Saura Maghadi | Pausha 24 / Magha 1 / Jan. 14 |
| Makara Samkranti (N.India), | The day of Saura Maghadi | Pausha 24 / Magha 1 / Jan. 14 |
| Makaradisnana | The day of Saura Maghadi | Pausha 24 / Magha 1 / Jan. 14 |
| 67. Mattu Pongal or Kanumu | Day after Pongal | Pausha 25 / Magha 2 / Jan. 15 |
| 68. Guru Govind Singh's Birth Day | Pausha S 7 | Pausha 30 / Magha 7 / Jan. 20 |
| 69. Netajiûs Birthday | Fixed | Magha 3 / Magha 10 / Jan. 23 |
| 70. Republic Day | Fixed | Magha 6 / Magha 13 / Jan. 26 |
| 71. Sri Panchami, Vasant Panchami | Magha S 5 | Magha 27 / Phalgun 4 / Feb 16 |
| 72. Sivaji Jayanti | Fixed | Magha 30 / Phalguna 7 / Feb 19 |
| 73. Guru Ravidasûs Birthday | Magha S 15 | Phalguna 8/Phalguna 15/Feb 27 |
| 74. Birth Day of Swami Dayananda Saraswati (Founder of Arya Samaj) | Phalguna K 10 (Purnimanta) | Phalguna 17/Phalguna 24/March 8 |
| 75. Maha Sivaratri (Kashmir) | Magha K 13 | Phalguna 19/Phalguna 26/March 10 |
| 76. Maha Sivaratri, Maha Sivaratri (S.India) | Magha K 14(Prodosa & Nishithavyapini) | Phalguna 20/Phalguna 27/March 11 |
| 77. Maha Vishuva day | Day of Sunûs entry into Trop. Aries (Midnight rule) | Phalguna 29/Chaitra 6/March 20 |
| | | **Saka 1943/Kali 5121 /2021 A.D.** |
| 1. Indian New Yearûs Day | Fixed | Chaitra 1 / Chaitra 8/ Mar. 22 |
| 2. Holikadahana, Dolyatra | Phalguna S 15 (night) | Chaitra 7 / Chaitra 14/ Mar. 28 |
| 3. Holi, Hola, | Day after Holikadahana | Chaitra 8 / Chaitra 15/ Mar. 29 |
| Vasantotsava | Phalguna K 1 | Chaitra 8 / Chaitra 15/ Mar. 29 |
| 4. Chaitra Sukladi (Gudi Padava, Ugadi), | Chaitra S 1 | Chaitra 23/ Chaitra 30/Apr. 13 |
| Cheti Chand(Sindhi new year's day), | Chaitra S 1 | Chaitra 23/ Chaitra 30/Apr. 13 |
| Telugu new year's day, Vasanta | Chaitra S 1 | Chaitra 23/ Chaitra 30/Apr. 13 |
| Navaratrarambha, | | Chaitra 23/ Chaitra 30/Apr. 13 |
| Vaisakhi(Punjab, Hariyana, H.P., | SauraVaisakhadi (Sunrise Rule) | Chaitra 23/ Chaitra 30/Apr. 13 |
| Delhi&Odhisa), Visu(Kerela) | SauraVaisakhadi (Sunrise Rule) | Chaitra 23/ Chaitra 30/Apr. 13 |
| | | **Saka 1943/Kali 5122 /2021 A.D.** |
| 5. Chaitra Samkranti, Chadak Puja | SauraVaisakhadi (Midnight Rule) | Chaitra 24/ Vaisakha 1/Apr. 14 |
| (Bengal), Cheiraoba (Manipur), Maha | SauraVaisakhadi (Midnight Rule) | Chaitra 24 / Vaisakha 1/ Apr. 14 |
| Kumbha at Haridwar, Meshadi (T.N), | | Chaitra 24 / Vaisakha 1/ Apr. 14 |
| Tamil New Year's Day, | | Chaitra 24 / Vaisakha 1/ Apr. 14 |
| Dr. B.R.Ambedkar Jayanti, Beginning | Fixed | Chaitra 24 / Vaisakha 1/ Apr. 14 |
| of 5122 K.E. | | Chaitra 24 / Vaisakha 1/ Apr. 14 |
| 6. Vaisakhadi (Bengal), Bahag Bihu (Assam), | Day Following Saura Vaisakhadi (Midnight Rule) | Chaitra 25/ Vaisakha 2 / Apr. 15 |
| Shilhenba (Manipur) | Day Following Saura Vaisakhadi (Midnight Rule) | Chaitra 25/ Vaisakha 2 / Apr. 15 |
| Sarhul(Bihar) | Chaitra S 3 | Chaitra 25/ Vaisakha 2 / Apr. 15 |
| 7. Oli begins (Jain), Vasanti Pujarambha | Chaitra S 7 | Chaitra 29/ Vaisakha 6 / Apr. 19 |
| 8. Rama Navami | Chaitra S 9 | Vaisakha 1 / Vaisakha 8 /Apr. 21 |
| 9. Babu Kuer Singh Day (Bihar) | Fixed | Vaisakha 3 / Vaisakha 10 /Apr. 23 |
| 10. Mahavira Jayanti | Chaitra S 13 | Vaisakha 5 / Vaisakha 12 /Apr. 25 |
| 11. Oli Ends(Jain) | Chaitra S 15 | Vaisakha 7 / Vaisakha 14 /Apr. 27 |
| 12. May day | Fixed | Vaisakha 11 / Vaisakha 18 / May 1 |
| 13. Birthday of Rabindranath | 25 Vaisakha of Beng. Calendar | Vaisakha 19/ Vaisakha 26 / May 9 |
| 14. Tithi of Deva Damodara(Assam) | S1 of Saura Vaisakha | Vaisakha 22/ Vaisakha 29 / May 12 |

## PRINCIPAL FESTIVALS AND ANNIVERSARIES FOR HOLIDAYS

| Festivals | Criterion | Date |
|---|---|---|
| | | **National / Nirayana / Gregorian Saka 1943/Kali 5122/2021 A.D.** |
| 15. Akshya Tritiya | Vaisakha S3 | Vaisakha 24/ Vaisakha 31/May 14 |
| 16. Akshya Tritiya (Bengal) | Vaisakha S3 (Tithi more than one muhurta) | Vaisakha 25/ Jyaishtha 1/May 15 |
| 17. Buddha Purnima | Vaisakha S15 | Jyaishtha 5/Jyaishtha12/May 26 |
| 18. Pratap Jayanti (Rajasthan) | Jyaishtha S3 | Jyaishtha 23/Jyaishtha30/June13 |
| 19. Guru Arjan Devôs Martyrdom Day | Jyaishtha S4 | Jyaishtha 24/Jyaishtha31/June14 |
| 20. Rajas Samkranti (Odisha) | Saura Ashadhadi (Sunrise rule) | Jyaishtha 25/ Ashadha 1/June15 |
| 21. Rathayatra | Ashadha S2 | Ashadha 21/ Ashadha 28/July12 |
| 22. Kharchi Puja (Tripura) | Ashadha S8 | Ashadha 26/ Sravana 2/July 17 |
| 23. Punaryatra(Smarta) | Ashadha S10 | Ashadha 28/ Sravana 4/July 19 |
| 24. Ultaratha (Odisha), Bahudha Yatra | 9th day from Rathayatra | Ashadha 29/ Sravana 5/July 20 |
| 25. Ker Puja (Tripura) | First Tuesday or Saturday after 14 days from Kharchi Puja not falling on K10 | Sravana 9/ Sravana 16/July 31 |
| 26. Tilak Commemoration Day | Fixed | Sravana 10/ Sravana 17/Aug 1 |
| 27. Karkataka Vavu (Kerala) | K30 of Saura Sravana | Sravana 17/ Sravana 24/Aug 8 |
| 28. Independence Day | Fixed | Sarvana 24/ Sravana 31/Aug 15 |
| 29. Jhulana Yatrarambha | Sravana S11 | Sravana 27/Bhadra 3/Aug 18 |
| 30. First Onam Day | Day before Thiru Onam Day | Sravana 29/ Bhadra 5/Aug 20 |
| 31. Rik Upakarma, | Sravana Nak. of Chandra Sravana | Sravana 30/Bhadra 6/Aug 21 |
| Onam or Thiru Onam Day | Sravana Nak. of Saura Bhadra | Sravana 30/Bhadra 6/Aug 21 |
| 32. Raksha Bandhan, | Sravana S15 (Pradosa) | Sravana 31/Bhadra 7/Aug 22 |
| Jhulana Yatra Samapanna, | Sravana S15 (Purvahna) | Sravana 31/Bhadra 7/Aug 22 |
| Naroli Purnima, | Sravana S15 (Aparahna & Sayahna) | Sravana 31/Bhadra 7/Aug 22 |
| Solono (Rakhi Bandhan), | Sravana S15 (Udayavyapini) | Sravana 31/Bhadra 7/Aug 22 |
| Avani Avittam (S.India), | Sravana S15 | Sravana 31/Bhadra 7/Aug 22 |
| Third Onam Day | Day after Thiru Onam Day | Sravana 31/Bhadra 7/Aug 22 |
| 33. Fourth Onam Day | Two Days after Thiru Onam Day | Bhadra 1/Bhadra 8/Aug 23 |
| 34. Tithi of Sri Madhava Deva (Assam) | K5 of Saura Bhadra | Bhadra 5/Bhadra 12/Aug 27 |
| 35. Janmashtami | Sravana K8 | Bhadra 8/Bhadra 15/Aug 30 |
| 36. Gokulashtami (Nandotsava), | Day after Janmashtami | Bhadra 9/Bhadra 16/Aug 31 |
| Sri Jayanti (Ramanuja) | Rohini Nakshatra of Saura Bhadra | Bhadra 9/Bhadra 16/Aug 31 |
| 37. Paryusana Parvarambha (Chaturthi Paksha-Jain) | 7 Days before Samvatsari (Chaturthi Paksha) | Bhadra 12/ Bhadra 19/Sep 3 |
| 38. Paryusana Parvarambha (Panchami Paksha-Jain) | 7 Days before Samvatsari (Panchami Paksha) | Bhadra 13/ Bhadra 20/Sep 4 |
| 39. Jain Festival | Sravana K30 (Udayavyapini) | Bhadra 16/ Bhadra 23/Sep 7 |
| 40. Tithi of Sri Sankara Deva (Assam) | S2 of Saura Bhadra | Bhadra 17/ Bhadra 24/Sep 8 |
| 41. Vinayak Chaturthi (Tamilnadu), | S4 of Saura Bhadra | Bhadra 19/ Bhadra 26/Sep 10 |
| Ganesha Chaturthi, | Bhadra S4 | Bhadra 19/ Bhadra 26/Sep 10 |
| Samvatsari (Chaturthi Paksha-Jain) | Bhadra S4 (Udayavyapini) | Bhadra 19/ Bhadra 26/Sep 10 |
| 42. Samvatsari (Panchami Paksha-Jain) | Bhadra S5 | Bhadra 20/ Bhadra 27/Sep 11 |
| 43. Radhastami | Bhadra S8 | Bhadra 23/ Bhadra 30/Sep 14 |
| 44. Ananta Chaturdasi | Bhadra S14 | Bhadra 28/ Asvina 4/Sep 19 |
| 45. Samadhi Day of Narayan Guru (Kerala) | Fixed | Bhadra 30/ Asvina 6/Sep 21 |
| 46. Mahatma Gandhiôs Birthday | Fixed | Asvina 10/Asvina 17/Oct 2 |
| 47. Mahalaya Amavasya, Sarvapitri | Bhadra K30 | Asvina 14/Asvina 21/Oct 6 |
| Amavasya, Tarpana Layba (Manipur), | Bhadra K30 | Asvina 14/Asvina 21/Oct 6 |
| Gajacchaya Parva | Bhadra K30 | Asvina 14/Asvina 21/Oct 6 |
| 48. Saradiya Navaratrarambha | Asvina S1 | Asvina 15/Asvina 22/Oct 7 |
| 49. Durga Puja Begins (Saptami), | Asvina S7 | Asvina 20/Asvina 27/Oct 12 |
| Oli Begins | Eight Days before Oli Ends | Asvina 20/Asvina 27/Oct 12 |
| 50. Durga Puja (Mahashtami) | Asvina S8 | Asvina 21/Asvina 28/Oct 13 |

## PRINCIPAL FESTIVALS AND ANNIVERSARIES FOR HOLIDAYS

| Festivals | Criterion | Date<br>National / Nirayana / Gregorian<br>Saka 1943 / Kali 5122 / 2021 A.D |
|---|---|---|
| 51. Durga Puja (Mahanavami), | Asvina S9 | Asvina 22/Asvina 29/Oct 14 |
| Ayudha Puja | Day before Dussehara | Asvina 22/Asvina 29/Oct 14 |
| 52. Vijaya Dasami (Dussehara or | Asvina S10 (Aparahna) | Asvina 23/Asvina 30/Oct 15 |
| Dasahara), Vijaya Dasami (Bengal & Kerala) | Asvina S10 (Purvahna) | Asvina 23/Asvina 30/Oct 15 |
| 53. Kaveri Samkramana Snana | Saura Kartikadi (Midnight Rule) | Asvina 25/Kartika 2/Oct 17 |
| 54. Kumara Purnima (Odisha) | Asvina S15 (Pradosa) | Asvina 28/Kartika 5/Oct 20 |
| Maharshi Valmiki's Birthday, | Asvina S15 (Udayavyapini) | Asvina 28/Kartika 5/Oct 20 |
| Oli Ends, | Asvina S15 (Udayavyapini) | Asvina 28/Kartika 5/Oct 20 |
| Kojagori Lakshmi Puja (Bengal) | Asvina S15 (Pradosa) | Asvina 28/Kartika 5/Oct 20 |
| 55. Dipavali (S.India) | Asvina K14 | Kartika12/Kartika 19/Nov 3 |
| 56. Naraka Chaturdasi(Purvarunodaya), | Asvina K14 (Purvarunodaya) | Kartika13/Kartika 20/Nov 4 |
| Dipavali, Kali Puja | Asvina K30 | Kartika13/Kartika 20/Nov 4 |
| 57. Kartika Sukladi, Govardhana Puja, | Kartika S1 | Kartika14/Kartika 21/Nov 5 |
| Bali Puja | Kartika S1 | Kartika14/Kartika 21/Nov 5 |
| 58. Bhratri Dvitiya, Tikka Ceremony, Bhai Duj,Dwat Puja, | Kartika S2 (Aparahna) | Kartika15/Kartika 22/Nov 6 |
| Bhratri Dvitiya (Bengal) | Kartika S2 (Madhyahna) | Kartika15/Kartika 22/Nov 6 |
| 59. Pratihara Shashthi or Surya Shashthi, | Kartika S6 | Kartika19/Kartika 26/Nov 10 |
| Chhat (Bihar) | Kartika S6 | Kartika19/Kartika 26/Nov 10 |
| 60. Rasayatra (Smarta) | Kartika S15 (Nisithavyapini) | Kartika 27/Agrahayana 4/Nov 18 |
| 61. Rasayatra (Vaishnava), | Kartika S15 (Udayavyapini) | Kartika 28/Agrahayana5/Nov 19 |
| Kartiki Purnima, | Kartika S15 | Kartika 28/Agrahayana 5/Nov 19 |
| Rathayatra (Jain), Guru Nanak's | Kartika S15 (Udayavyapini) | Kartika 28/Agrahayana 5/Nov 19 |
| Birthday, Puskar Fair, | Kartika S15 | Kartika 28/Agrahayana 5/Nov 19 |
| Huthri-3 Days (Coorg) | S15 to K2 of Saura Margasirsha | Kartika 28/Agrahayana 5/Nov 19 |
| 62. Guru Teg Bahadur's Martyrdom Day | Fixed | Agrahaya 3/Agrahayana10/Nov 24 |
| 63. Prathamashtami (Odisha) | Kartika K8 | Agrahaya 6/Agrahayna 13/Nov 27 |
| 64. Jor Mela-3 Days (Punjab) | Fixed | Pausha 5/Pausha 12/Dec 26 |
| | | **1943 S.E./ 5122 K.E./ 2022 A.D**. |
| 65. Guru Govind Singh's Birthday | Pausha S7 | Pausha 19/Pausha 26/Jan 9 |
| 66. Vaikuntha Ekadasi (S.India), | S11 of Saura Pausha | Pausha 23/Pausha 30/Jan 13 |
| Bhogi (S.India) | Day before Pongal | Pausha 23/Pausha 30/Jan 13 |
| 67. Makara Samkranti (Bengal), Magha | The Day of Saura Maghadi | Pausha 24/Magha 1/Jan 14 |
| Bihu (Assam), Makara Snana, Tila | The Day of Saura Maghadi | Pausha 24/Magha 1/Jan 14 |
| Samkranti, Pongal (S.India), | The Day of Saura Maghadi | Pausha 24/Magha 1/Jan 14 |
| Makara Samkranti (N.India) | The Day after Lohri | Pausha 24/Magha 1/Jan 14 |
| 68. Mattu Pongal or Kanumu , | The Day after Pongal | Pausha 25/Magha 2/Jan 15 |
| Tai Pongal (Kerala) | The Day of Saura Maghadi (18 Ghatika rule) | Pausha 25/Magha 2/Jan 15 |
| 69. Netaji's Birthday | Fixed | Magha 3/Magha10/Jan 23 |
| 70. Republic Day | Fixed | Magha 6/Magha13/Jan 26 |
| 71. Sri Panchami, Vasanta Panchami | Magha S5 | Magha 16/Magha 23/Feb 5 |
| 72. Guru Ravi Das's Birthday | Magha S15 | Magha 27/Phalguna 4/Feb 16 |
| 73. Sivaji Jayanti | Fixed | Magha 30/Phalguna 7/Feb 19 |
| 74. Birthday of Swami Dayananda Saraswati (Fouder of Arya Swamaj) | Phalguna K10 (Purnimanta) | Phalguna 7/Phalguna 14/Feb 26 |
| 75. Maha Shivratri | Magha K14 | Phalguna 10/ Phalguna 17/Mar 1 |
| 76. Holikadahana | Phalguna S15( Night) | Phalguna 26/ Chaitra 3/Mar 17 |
| 77. Dolyatra, | Phalguna S15 | Phalguna 27/Chaitra 4 /Mar 18 |
| Holi | Day after Holikadahan | |
| 78. Hola, Vasantotsava | Phalguna K1 | Phalguna 28/Chaitra 5/Mar 19 |
| 79. Mahavishuva Day | Day of Sun's entry into Trop. Aries (Midnight rule) | Phalguna 29/Chaitra 6/Mar 20 |

## Special Festivals for Jammu and Kashmir

| Festivals | Criterion | Date |
|---|---|---|
| | | **National / Nirayana / Gregorian** |
| | | **Saka 1942/ Kali 5121/ 2021 A.D.** |
| 7. Lohri | Day before Saura Maghadi (Sunrise Rule ) | Pausha 23/ Pausha 30/ Jan 13 |
| | | **Saka 1943/ Kali 5122/ 2021 A.D.** |
| 1. Mela Bahu Fort | Chaitra S 8 | Chaitra 30 / Vaisakha 7/ April 20 |
| 2. Mela Kshir Bhawani | Jyaishtha S 8 | Jyaishtha 28/ Ashadha 4 / June 18 |
| 3. Guru Hargobind's Birthday | Jyaishtha K 1 | Ashadha 4 / Ashadha 11/ June 25 |
| 4. Martyr's Day | Fixed | Asadha 22 / Asadha 29 / July 13 |
| 5. Kailas Yatra | Sravana K 13 & K 14 | Bhadra 14 / Bhadra 21 / Sep 5 |
| 6. Mela Pat | Bhadra S 5 to S 7 | Bhadra 20 / Bhadra 27 / Sep 11 |
| | | **Saka 1943/ Kali 5122/ 2022 A.D.** |
| 7. Lohri | Day before Saura Maghadi (Sunrise Rule ) | Pausha 23/ Pausha 30/ Jan.13 |

### MOSLEM FESTIVALS, 2021-2022 A.D.

| Festivals | Criterion | Date |
|---|---|---|
| | | **National / Nirayana / Gregorian** |
| | | **Saka 1943 / Kali 5121 / 2021 A.D** |
| 1. Sab-e-Barat* | 15 Shaban | Chaitra 9 / Chaitra 16 / March 30 |
| | | **Saka 1943 / Kali 5122 / 2021 A.D** |
| 2. First Day of Ramadan | 1 Ramadan | Chaitra 24/Vaisakha 01/April 14 |
| 3. Shahadat-e-Hazrat Ali | 21 Ramadan | Vaisakha 14/Vaisakha 21/May 04 |
| 4. Jumat ul Vida | Last Friday of Ramadan | Vaisakha 17/Vaisakha 24/May 07 |
| 5. Sab-e-Qadr* | 27 Ramadan | Vaisakha 20/Vaisakha 27/May 10 |
| 6. Id-ul-Fitr | 1 Shawwal | Vaisakha 24/Vaisakha 31/May 14 |
| 7. Id-uz-Zuha (Bakrid) | 10 Zulhijja | Ashadha 30/Sravana 06/July 21 |
| 8. Muharram | 10 Muharram | Sravana 28/Bhadra 04/Aug. 19 |
| 9. Chelhum | Fortieth Day from (39 days after) 10 Muharram | Asvina 05/Asvina 12/Sep. 27 |
| 10. Akheri Chahar Shumba | Last Wednesday of Safar | Asvina 14/Asvina 21/Oct. 06 |
| 11. Shahadat-e- Iman Hasan | 28 Safar | Asvina 14/Asvina 21/Oct. 06 |
| 12. Milad-un-Nabi or Id-e-Milad (Birthday of Prophet), Fateha Dwaz Daham or Bara Wafat | 12 Rabiu'lawwal | Asvina 27/Kartika 04/Oct. 19 |
| 13. Id-e-Maulad | 17 Rabiu'lawwal | Kartika 02/Kartika 09/Oct. 24 |
| 14. Fateha Yazdaham (Giarhween Sharif) | 11 Rabiu's sani | Kartika 26/Agrahayana 03/Nov. 17 |
| | | **Saka 1943 / Kali 5122 / 2022 A.D** |
| 15. Hazrat Ali's Birthday | 13 Rajab | Magha 26/Phalguna 03/Feb. 15 |
| 16. Sab-e-Miraj* | 27 Rajab | Phalguna 10/Phalguna 17/Mar. 01 |
| 17. Sab-e-Barat* | 15 Shaban | Phalguna 28/Chaitra 05/Mar. 19 |
| | | **Saka 1944 / Kali 5122 / 2022 A.D** |
| 1. First Day of Ramadan | 1 Ramadan | Chaitra 13/ Chaitra 20 /April 03 |

* The festival is observed in the preceding night

### THE ISLAMIC CALENDAR 2021-2022 A.D. (Hejira : 1442-1443 A. H.)

The beginning dates of the different months of the Islamic Calendar for the year 2021-2022 A.D. determined on the basis of the first visibility of the lunar crescent after the New-Moon day culculated for the Central Station of India are as follows:-

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Jumadu's sani | 1442 | Jan. 15 | 2021 | (30) | Safar | 1443 | Sept. 09 | 2021 | (29) |
| Rajab | " | Feb. 14 | " | (30) | Rabiu'l awwal | " | Oct. 08 | " | (30) |
| Shaban | " | Mar. 16 | " | (29) | Rabiu's sani | " | Nov. 07 | " | (29) |
| Ramadan | " | Apr. 14 | " | (30) | Jumadu' lawwal | " | Dec. 06 | " | (30) |
| Shawwal | " | May 14 | " | (29) | Jumadu's sani | " | Jan. 05 | 2022 | (29) |
| Zu'lqada | " | Jun. 12 | " | (30) | Rajab | " | Feb. 03 | " | (30) |
| Zulhijja | " | Jul. 12 | " | (29) | Shaban | " | Mar. 05* | " | (29) |
| MUHARRAM | 1443 | Aug. 10 | " | (30) | Ramadan | " | Apr. 03 | " | (30) |

N.B.-Actually the months begin from sunset of the preceding day when the Moon becomes first visible.
*It is a rare chance that Moon will be visble on 03.03.2022.

Fixed Calendar

According to the Fixed Calendar the beginning dates of different months are as follows : Jan 15 (2021 A.D.), Feb 13, Mar 15, Apr 13, May 13, June 11, July 11, Aug 10, Sep 09, Oct 08, Nov 07, Dec 06, Jan 05 (2022 A.D.), Feb 03, Mar 05, Apr 03.

## THE PARSI (SHAHENSHAHI) CALENDAR, 2021 - 2022 A.D.

(As used by the Indian Parsis)

Yazdejardi Era : 1390 - 1391

The beginning dates of different months of the Parsi Shahenshahi Calendar are as follows :
As regards the Parsi Kadmi Calendar, the months are the same but they begin 30 days earlier.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Shahrivar | 1390 | Jan. 13 | 2021 | (30) | Ardibehesht | 1391 | Sept. 15 | 2021 | (30) |
| Meher | " | Feb. 12 | " | (30) | Khordad | " | Oct. 15 | " | (30) |
| Avan | " | Mar. 14 | " | (30) | Tir | " | Nov. 14 | " | (30) |
| Adar | " | Apr. 13 | " | (30) | Amardad | " | Dec. 14 | " | (30) |
| Dei | " | May 13 | " | (30) | Shahrivar | " | Jan. 13 | 2022 | (30) |
| Bahman | " | June 12 | " | (30) | Meher | " | Feb. 12 | " | (30) |
| Aspandad | " | July 12 | " | (30) | Avan | " | Mar. 14 | " | (30) |
| *Gathas*(I-V) | " | Aug. 11 | " | ( 5) | Adar | " | Apr. 13 | " | (30) |
| FARVARDIN | 1391 | Aug. 16 | " | (30) | Dei | " | May 13 | " | (30) |

### PARSI FESTIVALS 2021-2022 A.D.

| Festivals | Criterion | Shahenshahi | Kadmi |
|---|---|---|---|
| | | **National / Nirayana / Gregorian Saka 1943/ Kali 5122/ 2021 A.D.** | **National / Nirayana / Gregorian Saka 1943/ Kali 5122/ 2021 A.D.** |
| Zarthost-no-Diso | 11 Dei | Jyaishtha 2/ Jyaishtha 9/ May 23 | Vaisakha 3/ Vaisakha 10/ Apr. 23 |
| Gatha Gahambar | Gatha III | Sravana 22/ Sravana 29/ Aug. 13 | Ashadha 23/ Ashadha 30/ July 14 |
| Parsi New Year Eve | Gatha V | Sravana 24/ Sravana 31/ Aug. 15 | Ashadha 25/ Sravana 1/ July 16 |
| Parsi New Year's Day | 1 Farvardin | Sravana 25/ Bhadra 1/ Aug. 16 | Ashadha 26/ Sravana 2/ July 17 |
| Khordad Sal (Birthday of Prophet Zarthost) | 6 Farvardin | Shravana 30/ Bhadra 6/ Aug. 21 | Ashadha 31/ Sravana 7/ July 22 |

N.B.- Jamshedi Naoroj falls on March 21 every year

## THE JEWISH CALENDAR, 2021 - 2022 A.D.

Jewish Era : 5781 - 82 A.M.

To beginning dates of different months of the Jewish Calendar are as follows:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Shebat | 5781 | Jan. 14 | 2021 | (30) | TISHRI | 5782 | Sept. 07 | 2021 | (30) |
| Adar | " | Feb. 13 | " | (29) | Heshvan | " | Oct. 07 | " | (30) |
| Nisan | " | Mar. 14 | " | (30) | Kislev | " | Nov. 06 | " | (30) |
| Iyar | " | Apr. 13 | " | (29) | Tebeth | " | Dec. 06 | " | (29) |
| Sivan | " | May 12 | " | (30) | Shebat | " | Jan. 04 | 2022 | (30) |
| Tammuz | " | June 11 | " | (29) | Veadar | " | Feb. 03 | " | (30) |
| Ab | " | July 10 | " | (30) | Adar | " | Mar. 05 | " | (29) |
| Ellul | " | Aug. 09 | " | (29) | Nisan | " | Apr. 03 | " | (30) |

### JEWISH FESTIVALS 2021-2022 A.D.

| Festivals | Criterion | Date |
|---|---|---|
| | | **National / Nirayana / Gregorian** |
| | | **Saka 1943 / Kali 5121 / 2021 AD** |
| First day of Passover (Pesach) | 15 Nisan | Chaitra 07 /Chaitra 14/ March 28 |
| | | **Saka 1943 / Kali 5122 / 2021 AD** |
| Feast of Weeks (Shebuoth) | 6 Sivan | Vaisakha 27/ Jyaishtha 3 / May 17 |
| Tishabeab | 9 Ab | Ashadha 27/ Sravana 3/ July 18 |
| Jewish New Year (Rosh Hashnah) | 1 Tishri | Bhadra 16/Bhadra 23 / September 07 |
| Day of Atonment (Yom Kippur) | 10 Tishri | Bhadra 25/Asvina 1/ September 16 |
| First day of Tabernacles (Succoth) | 15 Tishri | Bhadra 30/ Asvina 6 / September 21 |
| Last day of Succoth(Simhath Torah) | 23 Tishri | Asvina 7/ Asvina 14 / September 29 |
| Hanukah | 25 Kislev | Agrahayana 9/ Agrh. 16/Nov. 30 |
| | | **Saka 1943/Kali 5122 / 2022 A.D.** |
| Purim | 14 Adar | Phalguna 27/ Chaitra 4 / March 18 |
| | | **Saka 1944/Kali 5123 / 2022 A.D.** |
| First day of Passover (Pesach) | 15 Nisan | Chaitra 27/Vaisakha 4 / April 17 |

**CHRISTIAN FESTIVALS, 2021-2022 A.D.**

| Festivals | Criterion | Date |
|---|---|---|
| | | **National / Nirayana / Gregorian** |
| | | **Saka 1942 / Kali 5121/ 2021 A.D.** |
| 1. Christian (English) New Year's Day | Fixed | Pausha 11 / Pausha 18 / Jan. 01 |
| 2. Epiphany | Fixed | Pausha 16 / Pausha 23 / Jan. 06 |
| 3. Septuagesima Sunday | 63 days before Easter Sunday | Magha 11/Magha 18/ Jan 31 |
| 4. Quinquagesima (Shrove) Sunday | 49 days before Easter Sunday | Magha 25 /Phalguna 2/ Feb 14 |
| 5. Ash Wednesday | 46 days before Easter Sunday | Magha 28 /Phalguna 2/ Feb 17 |
| | | **Saka 1943/ Kali 5121 / 2021A.D.** |
| 6. Palm Sunday | 7 days before Easter Sunday | Chaitra 7/ Chaitra 14 / March 28 |
| 7. Good Friday | 2 days before Easter Sunday | Chaitra 12 / Chaitra 19 / April 2 |
| 8. Easter (Holy) Saturday | Day before Easter Sunday | Chaitra 13 / Chaitra 20 / April 3 |
| 9. Easter Sunday | First Sunday after the 14th day of the Moon (nearly Full Moon) occurring on or immediately after March 21 | Chaitra 14 / Chaitra 21 / April 4 |
| 10. Low Sunday | 7 days after Easter Sunday | Chaitra 21 / Chaitra 28 / April 11 |
| | | **Saka 1943/ Kali 5122 /2021 A.D.** |
| 11. Rogation Sunday | 35 days after Easter Sunday | Vaisakha 19/ Vaisakha 26 / May 9 |
| 12. Ascension Day-Holy Thursday | 39 days after Easter Sunday | Vaisakha 23/ Vaisakha 30 / May 13 |
| 13. Ascension Sunday | 3 days after Ascension day | Vaisakha 26 / Jyaishtha 2 / May 16 |
| 14. Whit Sunday-Pentecost | 49 days after Easter Sunday | Jyaishtha 2 / Jyaishtha 9 /May 23 |
| 15. Trinity Sunday | 56 days after Easter Sunday | Jyaishtha 9 / Jyaishtha 16 /May 30 |
| 16. Corpus Christi (Thursday) | 60 days after Easter Sunday | Jyaishtha 13 / Jyaishtha 20/June 3 |
| 17. First Sunday in Advent | Fourth Sunday before Christmas, i.e.,Sunday nearest to Nov.,30. | Agrahn. 7 /Agrahn. 14 / Nov 28 |
| 18. Christmas Eve | Day before Christmas | Pausha 03 / Pausha 10 / Dec. 24 |
| 19. Christmas Day | Fixed | Pausha 04 / Pausha 11 / Dec. 25 |
| 20. New Year Eve | Fixed | Pausha 10 / Pausha 17 / Dec. 31 |
| | | **Saka 1943/ Kali 5122 / 2022 A.D.** |
| 1. Christian (English) New Yearøs Day | Fixed | Pausha 11 / Pausha 18 / Jan. 01 |
| 2 Epiphany | Fixed | Pausha 16 / Pausha 23 / Jan. 06 |
| 3. Septuagesima Sunday | 63 days before Easter Sunday | Magha 24 / Phalguna 1 / Feb 13 |
| 4. Quinquagesima (Shrove) Sunday | 49 days before Easter Sunday | Phalguna 8/Phalguna 15 /Feb 27 |
| 5. Ash Wednesday | 46 days before Easter Sunday | Phalguna 11/ Phalguna 18/March 2 |
| | | **Saka 1944 / Kali 5122/ 2022 A.D.** |
| 6. Palm Sunday | 7 days before Easter Sunday | Chaitra 20/Chaitra 27 / April 10 |
| | | **Saka 1944 / Kali 5123/ 2022 A.D.** |
| 7. Good Friday | 2 days before Easter Sunday | Chaitra 25/ Vaisakha 2 / April 15 |
| 8. Easter (Holy) Saturday | Day before Easter Sunday | Chaitra 26/ Vaisakha 3 / April 16 |
| 9. Easter Sunday | First Sunday after the 14th day of the Moon (nearly Full Moon) occurring on or immediately after March 21 | Chaitra 27/Vaisakha 4/April 17 |

## THE INDIAN LUNAR CALENDAR

### TIME OF NEW MOON (IN I.S.T.) MARKING THE COMMENCEMENT OF LUNAR MONTHS

| | 2003 (1924 - 25 S.E.) | | | | 2006 (1927 - 28 S.E.) | | | | 2009 (1930 - 31 S.E.) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | d | h | m | | d | h | m | | d | h | m |
| Pausha | Jan. | 2 | 25 | 53 | | | --- | | | | --- | |
| Magha | Feb. | 1 | 16 | 19 | Jan. | 29 | 19 | 45 | Jan. | 26 | 13 | 25 |
| Phalguna | Mar. | 3 | 08 | 05 | Feb. | 27 | 30 | 01 | Feb. | 25 | 07 | 05 |
| Chaitra | Apr. | 1 | 24 | 48 | Mar. | 29 | 15 | 45 | Mar. | 26 | 21 | 36 |
| Vaisakha | May | 1 | 17 | 44 | Apr. | 27 | 25 | 14 | Apr. | 25 | 08 | 53 |
| Jyaishtha | May | 31 | 09 | 49 | May | 27 | 10 | 56 | May | 24 | 17 | 41 |
| Ashadha | June | 29 | 24 | 07 | June | 25 | 21 | 35 | June | 22 | 25 | 05 |
| Sravana | July | 29 | 12 | 21 | July | 25 | 10 | 01 | July | 22 | 08 | 05 |
| Bhadra | Aug. | 27 | 22 | 54 | Aug. | 23 | 24 | 40 | Aug. | 20 | 15 | 32 |
| Asvina | Sept | 26 | 08 | 37 | Sept. | 22 | 17 | 15 | Sept. | 18 | 24 | 14 |
| Kartika | Oct. | 25 | 18 | 19 | Oct. | 22 | 10 | 44 | Oct. | 18 | 11 | 03 |
| Margasirsha | Nov. | 23 | 28 | 28 | Nov. | 20 | 27 | 48 | Nov. | 16 | 24 | 44 |
| Pausha | Dec. | 23 | 15 | 13 | Dec. | 20 | 19 | 31 | Dec. | 17 | 17 | 32 |

| | 2004 (1925 - 26 S.E.) | | | | 2007 (1928 - 29 S.E.) | | | | 2010 (1931 - 32 S.E.) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pausha | | | --- | | | | --- | | | --- | | |
| Magha | Jan. | 21 | 26 | 35 | Jan. | 19 | 09 | 31 | Jan. | 15 | 12 | 41 |
| Phalguna | Feb. | 20 | 14 | 48 | Feb. | 17 | 21 | 44 | Feb. | 14 | 08 | 21 |
| Chaitra | Mar. | 20 | 28 | 11 | Mar. | 19 | 08 | 13 | Mar. | 15 | 26 | 31 |
| Vaisakha | Apr. | 19 | 18 | 51 | Apr. | 17 | 17 | 06 | *Apr.* | *14* | *17* | *59* |
| | | | | | | | | | May | 14 | 06 | 34 |
| Jyaishtha | May | 19 | 10 | 22 | *May* | *16* | *24* | *57* | June | 12 | 16 | 45 |
| | | | | | June | 15 | 08 | 43 | | | | |
| Ashadha | June | 17 | 29 | 57 | July | 14 | 17 | 34 | July | 11 | 25 | 10 |
| Sravana | *July* | *17* | *16* | *54* | Aug. | 12 | 28 | 33 | Aug. | 10 | 08 | 38 |
| | Aug. | 16 | 06 | 54 | | | | | | | | |
| Bhadra | Sept. | 14 | 19 | 59 | Sept. | 11 | 18 | 14 | Sept. | 8 | 16 | 00 |
| Asvina | Oct. | 14 | 08 | 18 | Oct. | 11 | 10 | 31 | Oct. | 7 | 24 | 15 |
| Kartika | Nov. | 12 | 19 | 57 | Nov. | 9 | 28 | 33 | Nov. | 6 | 10 | 22 |
| Margasirsha | Dec | 12 | 06 | 59 | Dec. | 9 | 23 | 10 | Dec. | 5 | 23 | 06 |
| Pausha | | | --- | | | | --- | | | | --- | |

| | 2005 (1926 - 27 S.E.) | | | | 2008 (1929 - 30 S.E.) | | | | 2011 (1932 - 33 S.E.) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pausha | Jan. | 10 | 17 | 33 | Jan. | 8 | 17 | 17 | Jan. | 4 | 14 | 33 |
| Magha | Feb. | 8 | 27 | 58 | Feb. | 7 | 09 | 14 | Feb. | 3 | 08 | 01 |
| Phalguna | Mar. | 10 | 14 | 40 | Mar. | 7 | 22 | 44 | Mar. | 4 | 26 | 16 |
| Chaitra | Apr. | 8 | 26 | 02 | Apr. | 6 | 09 | 25 | Apr. | 3 | 20 | 02 |
| Vaisakha | May | 8 | 14 | 15 | May | 5 | 17 | 48 | May | 3 | 12 | 21 |
| Jyaishtha | June | 6 | 27 | 25 | June | 3 | 24 | 53 | June | 1 | 26 | 33 |
| Ashadha | July | 6 | 17 | 33 | July | 3 | 07 | 49 | July | 1 | 14 | 24 |
| Sravana | Aug. | 5 | 08 | 35 | Aug. | 1 | 15 | 43 | July | 30 | 24 | 10 |
| Bhadra | Sept | 3 | 24 | 15 | Aug. | 30 | 25 | 28 | Aug. | 29 | 08 | 34 |
| Asvina | Oct. | 3 | 15 | 58 | Sept. | 29 | 13 | 42 | Sept. | 27 | 16 | 39 |
| Kartika | Nov. | 2 | 06 | 55 | Oct. | 28 | 28 | 44 | Oct. | 26 | 25 | 26 |
| Margasirsha | Dec. | 1 | 20 | 31 | Nov. | 27 | 22 | 25 | Nov. | 25 | 11 | 40 |
| Pausha | Dec. | 31 | 08 | 42 | Dec. | 27 | 17 | 52 | Dec. | 24 | 23 | 36 |

N.B.- The figures in the italics show the beginning of the intercalary (*mala or adhika*) month followed by the normal (*suddha or nija*) month of the same name.

## THE INDIAN LUNAR CALENDAR

TIME OF NEW MOON (IN I.S.T.) MARKING THE COMMENCEMENT OF LUNAR MONTHS

| | 2012 (1933 - 34 S.E.) | | | | 2015 (1936 - 37 S.E.) | | | | 2018 (1939 - 40 S.E) | | | | 2021 (1942 - 43 S.E) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | d | h | m | | d | h | m | | d | h | m | | d | h | m |
| | | | --- | | | | --- | | | | --- | | | | | |
| Pausha | Jan. | 23 | 13 | 09 | Jan. | 20 | 18 | 44 | Jan. | 17 | 07 | 47 | Jan. | 13 | 10 | 30 |
| Magha | Feb. | 21 | 28 | 05 | Feb. | 18 | 29 | 17 | Feb. | 15 | 26 | 35 | Feb. | 11 | 24 | 36 |
| Phalguna | Mar. | 22 | 20 | 07 | Mar. | 20 | 15 | 06 | Mar. | 17 | 18 | 42 | Mar. | 13 | 15 | 51 |
| Chaitra | Apr. | 21 | 12 | 48 | Apr. | 18 | 24 | 27 | Apr. | 16 | 07 | 27 | Apr. | 12 | 08 | 01 |
| Vaisakha | | | | | | | | | | | | | May | 11 | 24 | 30 |
| Jyaishtha | May | 20 | 05 | 17 | May | 18 | 09 | 43 | *May* | *15* | *17* | *18* | June | 10 | 16 | 23 |
| | | | | | | | | | June | 13 | 25 | 13 | | | | |
| Ashadha | June | 19 | 20 | 32 | *June* | *16* | *19* | *35* | July | 13 | 08 | 18 | July | 10 | 06 | 47 |
| | | | | | July | 16 | 06 | 54 | | | | | | | | |
| Sravana | July | 19 | 09 | 54 | Aug. | 14 | 20 | 23 | Aug. | 11 | 15 | 28 | Aug. | 08 | 19 | 20 |
| Bhadra | *Aug.* | *17* | *21* | *24* | Sept | 13 | 12 | 11 | Sept. | 09 | 23 | 32 | Sept. | 07 | 06 | 22 |
| | Sept. | 16 | 07 | 41 | | | | | | | | | | | | |
| Asvina | Oct. | 15 | 17 | 33 | Oct. | 12 | 29 | 36 | Oct. | 09 | 09 | 17 | Oct. | 06 | 16 | 35 |
| Kartika | Nov. | 13 | 27 | 38 | Nov. | 11 | 23 | 17 | Nov. | 07 | 21 | 32 | Nov. | 04 | 26 | 45 |
| Margasirsha | Dec. | 13 | 14 | 12 | Dec. | 11 | 15 | 59 | Dec. | 07 | 12 | 50 | Dec. | 04 | 13 | 13 |
| Pausha | | | --- | | | | --- | | | | --- | | | | --- | |

| | 2013 (1934 - 35 S.E.) | | | | 2016 (1937 - 38 S.E.) | | | | 2019 (1940 - 41 S.E.) | | | | 2022 (1943 - 44 S.E) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pausha | Jan. | 11 | 25 | 14 | Jan. | 10 | 07 | 01 | Jan. | 6 | 06 | 58 | Jan. | 2 | 24 | 04 |
| Magha | Feb. | 10 | 12 | 50 | Feb. | 8 | 20 | 09 | Feb. | 4 | 26 | 34 | Feb. | 1 | 11 | 16 |
| Phalguna | Mar. | 11 | 25 | 21 | Mar. | 9 | 07 | 25 | Mar. | 6 | 21 | 34 | Mar. | 2 | 23 | 05 |
| Chaitra | Apr. | 10 | 15 | 05 | Apr. | 7 | 16 | 54 | Apr. | 5 | 14 | 21 | Apr. | 1 | 11 | 54 |
| Vaisakha | May | 10 | 05 | 58 | May | 6 | 25 | 00 | May | 4 | 28 | 16 | Apr. | 30 | 25 | 58 |
| Jyaishtha | June | 8 | 21 | 26 | June | 5 | 08 | 30 | June | 3 | 15 | 32 | May | 30 | 17 | 00 |
| Ashadha | July | 8 | 12 | 44 | July | 4 | 16 | 31 | July | 2 | 24 | 46 | June | 29 | 08 | 22 |
| Sravana | Aug. | 6 | 27 | 21 | Aug. | 2 | 26 | 15 | Aug. | 1 | 08 | 42 | July | 28 | 23 | 25 |
| Bhadra | Sept. | 5 | 17 | 06 | Sept. | 1 | 14 | 33 | Aug. | 30 | 16 | 07 | Aug. | 27 | 13 | 47 |
| Asvina | Oct. | 5 | 06 | 05 | Sept. | 30 | 29 | 41 | Sept. | 28 | 23 | 56 | Sept. | 25 | 27 | 25 |
| Kartika | Nov. | 3 | 18 | 20 | Oct. | 30 | 23 | 08 | Oct. | 28 | 09 | 09 | Oct. | 25 | 16 | 19 |
| Margasirsha | Dec. | 2 | 29 | 52 | Nov. | 29 | 17 | 48 | Nov. | 26 | 20 | 36 | Nov. | 23 | 28 | 27 |
| Pausha | | | --- | | Dec. | 29 | 12 | 23 | Dec. | 26 | 10 | 43 | Dec. | 23 | 15 | 47 |

| | 2014 (1935 - 36 S.E.) | | | | 2017 (1938 - 39 S.E.) | | | | 2020 (1941 - 42 S.E.) | | | | 2023 (1944 - 45 S.E.) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pausha | Jan. | 1 | 16 | 44 | | | --- | | | | --- | | | | ------ | |
| Magha | Jan.. | 30 | 27 | 09 | Jan. | 27 | 29 | 37 | Jan. | 24 | 27 | 12 | Jan. | 21 | 26 | 23 |
| Phalguna | Mar. | 1 | 13 | 30 | Feb. | 26 | 20 | 28 | Feb. | 23 | 21 | 02 | Feb. | 20 | 12 | 36 |
| Chaitra | Mar. | 30 | 24 | 15 | Mar. | 28 | 08 | 27 | Mar. | 24 | 14 | 58 | Mar. | 21 | 22 | 53 |
| Vaisakha | Apr. | 29 | 11 | 44 | Apr. | 26 | 17 | 46 | Apr. | 23 | 07 | 56 | Apr. | 20 | 9 | 43 |
| Jyaishtha | May | 28 | 24 | 10 | May | 25 | 25 | 14 | May | 22 | 23 | 09 | May | 19 | 21 | 23 |
| Ashadha | June | 27 | 13 | 39 | June | 24 | 08 | 01 | June | 21 | 12 | 11 | June | 18 | 10 | 07 |
| Sravana | July | 26 | 28 | 12 | July | 23 | 15 | 16 | July | 20 | 23 | 03 | *July* | *17* | *24* | *02* |
| Bhadra | Aug. | 25 | 19 | 43 | Aug. | 21 | 24 | 00 | Aug. | 19 | 08 | 12 | Aug. | 16 | 15 | 08 |
| Asvina | Sept. | 24 | 11 | 44 | Sept. | 20 | 11 | 00 | *Sept.* | *17* | *16* | *30* | Sept. | 15 | 7 | 10 |
| Kartika | Oct. | 23 | 27 | 27 | Oct. | 19 | 24 | 42 | Oct. | 16 | 25 | 01 | Oct. | 14 | 23 | 25 |
| Margasirsha | Nov. | 22 | 18 | 02 | Nov. | 18 | 17 | 12 | Nov. | 15 | 10 | 37 | Nov. | 13 | 14 | 57 |
| Pausha | Dec. | 22 | 07 | 06 | Dec. | 18 | 12 | 00 | Dec. | 14 | 21 | 47 | Dec. | 12 | 29 | 02 |

N.B.- The figures in the italics show the beginning of the intercalary (*mala or adhika*) month followed by the normal (*suddha or nija*) month of the same name.

# INDIAN CALENDAR

SAKA ERA 1944 Mesha : Madhava

Month of CHAITRA(30 days) Spring (Vasanta), 2nd Month

(*Nirayana*) 7 Chaitra, 5122 Kali Era to (*Nirayana*) 7 Vaisakha, 5123 Kali Era

| Date | Week Day | Gregorian Date | | Sunrise | | Apparent Noon | | Sunset | | Tithi | | | | Nakshatra | | | Yoga | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | No. | | Ending Moment | | No. | Ending Moment | | No. | Ending Moment | |
| | | | | h | m | h | m | h | m | | | h | m | | h | m | | h | m |
| | | 2022 A.D. | | | | | | | | | | | | | | | | | |
| 1 | Tue | Mar | 22 | 6 | 02.4 | 12 | 06.9 | 18 | 11.6 | K | 4 | 6 | 24.6 | 16 | 20 | 13.6 | 14 | 13 | 8.8 |
| | | | | | | | | | | (K | 5 | 28 | 22.2) | | | | | | |
| 2 | Wed | | 23 | 6 | 01.5 | 12 | 06.6 | 18 | 12.0 | | 6 | 26 | 16.7 | 17 | 18 | 52.5 | 15 | 10 | 19.4 |
| 3 | Thu | | 24 | 6 | 00.5 | 12 | 06.3 | 18 | 12.4 | | 7 | 24 | 10.3 | 18 | 17 | 29.7 | 16 | 7 | 28.0 |
| | | | | | | | | | | | | | | | | | (17 | 28 | 36.4) |
| 4 | Fri | | 25 | 5 | 59.5 | 12 | 06.0 | 18 | 12.7 | | 8 | 22 | 04.7 | 19 | 16 | 07.4 | 18 | 25 | 45.9 |
| 5 | Sat | | 26 | 5 | 58.5 | 12 | 05.7 | 18 | 13.1 | | 9 | 20 | 02.1 | 20 | 14 | 47.4 | 19 | 22 | 58.0 |
| 6 | Sun | | 27 | 5 | 57.6 | 12 | 05.4 | 18 | 13.5 | K | 10 | 18 | 04.6 | 21 | 13 | 32.1 | 20 | 20 | 14.8 |
| 7 | Mon | | 28 | 5 | 56.6 | 12 | 05.1 | 18 | 13.9 | | 11 | 16 | 15.6 | 22 | 12 | 24.4 | 21 | 17 | 38.6 |
| 8 | Tue | | 29 | 5 | 55.6 | 12 | 04.8 | 18 | 14.2 | | 12 | 14 | 38.9 | 23 | 11 | 28.2 | 22 | 15 | 12.8 |
| 9 | Wed | | 30 | 5 | 54.6 | 12 | 04.5 | 18 | 14.6 | | 13 | 13 | 19.6 | 24 | 10 | 48.5 | 23 | 13 | 01.0 |
| 10 | Thu | | 31 | 5 | 53.7 | 12 | 04.2 | 18 | 15.0 | | 14 | 12 | 23.0 | 25 | 10 | 30.6 | 24 | 11 | 07.4 |
| 11 | Fri | Apr. | 1 | 5 | 52.7 | 12 | 03.9 | 18 | 15.3 | K | 30 | 11 | 54.4 | 26 | 10 | 39.9 | 25 | 9 | 35.8 |
| 12 | Sat | | 2 | 5 | 51.8 | 12 | 03.6 | 18 | 15.7 | S | 1 | 11 | 58.7 | 27 | 11 | 21.1 | 26 | 8 | 29.9 |
| 13 | Sun | | 3 | 5 | 50.8 | 12 | 03.3 | 18 | 16.1 | | 2 | 12 | 39.0 | 1 | 12 | 37.1 | 27 | 7 | 51.7 |
| 14 | Mon | | 4 | 5 | 49.8 | 12 | 03.1 | 18 | 16.5 | | 3 | 13 | 55.6 | 2 | 14 | 28.4 | 1 | 7 | 41.9 |
| 15 | Tue | | 5 | 5 | 48.9 | 12 | 02.8 | 18 | 16.8 | | 4 | 15 | 45.7 | 3 | 16 | 51.7 | 2 | 7 | 58.6 |
| 16 | Wed | | 6 | 5 | 47.9 | 12 | 02.5 | 18 | 17.2 | S | 5 | 18 | 01.9 | 4 | 19 | 39.7 | 3 | 8 | 37.2 |
| 17 | Thu | | 7 | 5 | 47.0 | 12 | 02.2 | 18 | 17.6 | | 6 | 20 | 33.2 | 5 | 22 | 41.4 | 4 | 9 | 30.6 |
| 18 | Fri | | 8 | 5 | 46.1 | 12 | 01.9 | 18 | 18.0 | | 7 | 23 | 05.6 | 6 | 25 | 43.2 | 5 | 10 | 29.6 |
| 19 | Sat | | 9 | 5 | 45.1 | 12 | 01.7 | 18 | 18.4 | | 8 | 25 | 24.4 | 7 | 28 | 30.7 | 6 | 11 | 23.6 |
| 20 | Sun | | 10 | 5 | 44.2 | 12 | 01.4 | 18 | 18.7 | | 9 | 27 | 16.1 | 8 | --- | --- | 7 | 12 | 02.6 |
| 21 | Mon | | 11 | 5 | 43.3 | 12 | 01.1 | 18 | 19.1 | S | 10 | 28 | 30.7 | 8 | 6 | 51.0 | 8 | 12 | 17.7 |
| 22 | Tue | | 12 | 5 | 42.4 | 12 | 00.9 | 18 | 19.5 | | 11 | 29 | 02.6 | 9 | 8 | 34.7 | 9 | 12 | 02.6 |
| 23 | Wed | | 13 | 5 | 41.5 | 12 | 00.6 | 18 | 19.9 | | 12 | 28 | 50.3 | 10 | 9 | 36.6 | 10 | 11 | 13.8 |
| 24 | Thu | | 14 | 5 | 40.6 | 12 | 00.3 | 18 | 20.3 | | 13 | 27 | 56.3 | 11 | 9 | 55.8 | 11 | 9 | 50.7 |
| 25 | Fri | | 15 | 5 | 39.7 | 12 | 00.1 | 18 | 20.7 | | 14 | 26 | 25.6 | 12 | 9 | 35.0 | 12 | 7 | 55.3 |
| | | | | | | | | | | | | | | | | | (13 | 29 | 31.5) |
| 26 | Sat | | 16 | 5 | 38.9 | 11 | 59.9 | 18 | 21.1 | S | 15 | 24 | 25.0 | 13 | 8 | 39.6 | 14 | 26 | 44.2 |
| 27 | Sun | | 17 | 5 | 38.0 | 11 | 59.6 | 18 | 21.5 | K | 1 | 22 | 02.0 | 14 | 7 | 16.5 | 15 | 23 | 39.5 |
| | | | | | | | | | | | | | | (15 | 29 | 33.5) | | | |
| 28 | Mon | | 18 | 5 | 37.1 | 11 | 59.4 | 18 | 21.9 | | 2 | 19 | 24.2 | 16 | 27 | 38.5 | 16 | 20 | 23.1 |
| 29 | Tue | | 19 | 5 | 36.3 | 11 | 59.2 | 18 | 22.3 | | 3 | 16 | 39.1 | 17 | 25 | 38.8 | 17 | 17 | 01.1 |
| 30 | Wed | | 20 | 5 | 35.5 | 11 | 59.0 | 18 | 22.7 | K | 4 | 13 | 53.4 | 18 | 23 | 41.2 | 18 | 13 | 38.7 |

N.B. - All timings are given in I.S.T. or the local mean time of the meridian of 82½° E. Long.

Names of Nakshatras:- 1.Asvini 2.Bharani 3.Krittika 4.Rohini 5.Mrigasiras 6.Ardra 7.Punarvasu 8.Pushya 9.Aslesha 10.Magha 11.Purva Phalguni 12.Uttara Phalguni 13.Hasta 14.Chitra 15.Svati 16.Visakha 17.Anuradha 18.Jyestha 19.Mula 20.Purvasadha 21.Uttarasadha 22.Sravana 23.Dhanistha 24.Satabhisaj 25.Purva Bhadrapada 26.Uttara Bhadrapada 27.Revati

Names of Yogas:- 1.Viskumbha 2.Priti 3.Ayusman 4.Saubhagya 5.Sobhana 6.Atiganda 7.Sukarma 8.Dhriti 9.Sula 10.Ganda 11. Vriddhi 12.Dhruva 13.Vyaghata 14.Harshana 15.Vajra 16.Siddhi (Asrik) 17.Vyatipata 18.Variyan 19.Parigha 20.Siva 21.Siddha 22.Sadhya 23.Subha 24.Sukla (Sukra) 25.Brahma 26.Indra 27.Vaidhriti

**AYNAMSA , 2021-22**

FOR $0^h$ TERRESTRIAL TIME

| Date 2021 | | Ayanamsa | | | Date 2021 | | Ayanamsa | | | Date 2021 | | Ayanamsa | | | Date 2021-22 | | Ayanamsa | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | | | ° | ' | " | | | ° | ' | " | | | ° | ' | " |
| Jan. | 1 | 24 | 08 | 45.5 | May | 1 | 24 | 09 | 00.8 | Aug. | 29 | 24 | 09 | 19.7 | Dec. | 27 | 24 | 09 | 36.7 |
| | 4 | 24 | 08 | 46.0 | | 4 | 24 | 09 | 01.5 | Sep. | 1 | 24 | 09 | 20.2 | | 30 | 24 | 09 | 37.0 |
| | 7 | 24 | 08 | 46.3 | | 7 | 24 | 09 | 01.7 | | 4 | 24 | 09 | 20.8 | Jan. | 2 | 24 | 09 | 37.9 |
| | 10 | 24 | 08 | 46.8 | | 10 | 24 | 09 | 01.9 | | 7 | 24 | 09 | 21.0 | | 5 | 24 | 09 | 38.9 |
| | 13 | 24 | 08 | 47.7 | | 13 | 24 | 09 | 02.3 | | 10 | 24 | 09 | 21.0 | | 8 | 24 | 09 | 39.3 |
| | 16 | 24 | 08 | 48.4 | | 16 | 24 | 09 | 02.9 | | 13 | 24 | 09 | 21.4 | | 11 | 24 | 09 | 39.5 |
| | 19 | 24 | 08 | 48.6 | | 19 | 24 | 09 | 03.6 | | 16 | 24 | 09 | 22.1 | | 14 | 24 | 09 | 40.1 |
| | 22 | 24 | 08 | 48.9 | | 22 | 24 | 09 | 03.9 | | 19 | 24 | 09 | 22.5 | | 17 | 24 | 09 | 40.8 |
| | 25 | 24 | 08 | 49.4 | | 25 | 24 | 09 | 04.1 | | 22 | 24 | 09 | 22.5 | | 20 | 24 | 09 | 41.4 |
| | 28 | 24 | 08 | 50.2 | | 28 | 24 | 09 | 04.9 | | 25 | 24 | 09 | 22.5 | | 23 | 24 | 09 | 41.7 |
| | 31 | 24 | 08 | 50.6 | | 31 | 24 | 09 | 05.8 | | 28 | 24 | 09 | 23.0 | | 26 | 24 | 09 | 41.9 |
| Feb. | 3 | 24 | 08 | 50.8 | June | 3 | 24 | 09 | 06.2 | Oct. | 1 | 24 | 09 | 23.5 | | 29 | 24 | 09 | 42.6 |
| | 6 | 24 | 08 | 51.2 | | 6 | 24 | 09 | 06.4 | | 4 | 24 | 09 | 23.8 | Feb. | 1 | 24 | 09 | 43.5 |
| | 9 | 24 | 08 | 51.9 | | 9 | 24 | 09 | 06.8 | | 7 | 24 | 09 | 23.8 | | 4 | 24 | 09 | 43.9 |
| | 12 | 24 | 08 | 52.5 | | 12 | 24 | 09 | 07.6 | | 10 | 24 | 09 | 24.1 | | 7 | 24 | 09 | 44.0 |
| | 15 | 24 | 08 | 52.6 | | 15 | 24 | 09 | 08.3 | | 13 | 24 | 09 | 24.8 | | 10 | 24 | 09 | 44.4 |
| | 18 | 24 | 08 | 52.7 | | 18 | 24 | 09 | 08.7 | | 16 | 24 | 09 | 25.3 | | 13 | 24 | 09 | 45.0 |
| | 21 | 24 | 08 | 53.1 | | 21 | 24 | 09 | 09.0 | | 19 | 24 | 09 | 25.3 | | 16 | 24 | 09 | 45.5 |
| | 24 | 24 | 08 | 53.7 | | 24 | 24 | 09 | 09.7 | | 22 | 24 | 09 | 25.5 | | 19 | 24 | 09 | 45.7 |
| | 27 | 24 | 08 | 54.1 | | 27 | 24 | 09 | 10.6 | | 25 | 24 | 09 | 25.9 | | 22 | 24 | 09 | 45.8 |
| Mar. | 2 | 24 | 08 | 54.1 | | 30 | 24 | 09 | 11.1 | | 28 | 24 | 09 | 26.5 | | 25 | 24 | 09 | 46.3 |
| | 5 | 24 | 08 | 54.4 | July | 3 | 24 | 09 | 11.4 | | 31 | 24 | 09 | 27.0 | | 28 | 24 | 09 | 47.0 |
| | 8 | 24 | 08 | 55.0 | | 6 | 24 | 09 | 11.8 | Nov. | 3 | 24 | 09 | 27.1 | Mar. | 3 | 24 | 09 | 47.3 |
| | 11 | 24 | 08 | 55.5 | | 9 | 24 | 09 | 12.5 | | 6 | 24 | 09 | 27.4 | | 6 | 24 | 09 | 47.3 |
| | 14 | 24 | 08 | 55.6 | | 12 | 24 | 09 | 13.2 | | 9 | 24 | 09 | 28.3 | | 9 | 24 | 09 | 47.6 |
| | 17 | 24 | 08 | 55.6 | | 15 | 24 | 09 | 13.6 | | 12 | 24 | 09 | 28.9 | | 12 | 24 | 09 | 48.1 |
| | 20 | 24 | 08 | 55.9 | | 18 | 24 | 09 | 13.8 | | 15 | 24 | 09 | 29.1 | | 15 | 24 | 09 | 48.6 |
| | 23 | 24 | 08 | 56.4 | | 21 | 24 | 09 | 14.4 | | 18 | 24 | 09 | 29.3 | | 18 | 24 | 09 | 48.7 |
| | 26 | 24 | 08 | 56.8 | | 24 | 24 | 09 | 15.3 | | 21 | 24 | 09 | 29.9 | | 21 | 24 | 09 | 48.7 |
| | 29 | 24 | 08 | 56.8 | | 27 | 24 | 09 | 15.8 | | 24 | 24 | 09 | 30.6 | | 24 | 24 | 09 | 49.1 |
| Apr. | 1 | 24 | 08 | 57.0 | | 30 | 24 | 09 | 15.9 | | 27 | 24 | 09 | 31.2 | | 27 | 24 | 09 | 49.8 |
| | 4 | 24 | 08 | 57.7 | Aug. | 2 | 24 | 09 | 16.2 | | 30 | 24 | 09 | 31.5 | | 30 | 24 | 09 | 50.1 |
| | 7 | 24 | 08 | 58.2 | | 5 | 24 | 09 | 16.8 | Dec. | 3 | 24 | 09 | 31.9 | Apr. | 2 | 24 | 09 | 50.1 |
| | 10 | 24 | 08 | 58.3 | | 8 | 24 | 09 | 17.5 | | 6 | 24 | 09 | 32.8 | | 5 | 24 | 09 | 50.3 |
| | 13 | 24 | 08 | 58.3 | | 11 | 24 | 09 | 17.8 | | 9 | 24 | 09 | 33.6 | | 8 | 24 | 09 | 50.9 |
| | 16 | 24 | 08 | 58.7 | | 14 | 24 | 09 | 17.9 | | 12 | 24 | 09 | 34.0 | | 11 | 24 | 09 | 51.4 |
| | 19 | 24 | 08 | 59.2 | | 17 | 24 | 09 | 18.3 | | 15 | 24 | 09 | 34.3 | | 14 | 24 | 09 | 51.6 |
| | 22 | 24 | 08 | 59.7 | | 20 | 24 | 09 | 19.1 | | 18 | 24 | 09 | 34.9 | | 17 | 24 | 09 | 51.6 |
| | 25 | 24 | 08 | 59.9 | | 23 | 24 | 09 | 19.5 | | 21 | 24 | 09 | 35.7 | | 20 | 24 | 09 | 52.1 |
| | 28 | 24 | 09 | 00.1 | | 26 | 24 | 09 | 19.6 | | 24 | 24 | 09 | 36.4 | | 23 | 24 | 09 | 52.9 |
| May | 1 | 24 | 09 | 00.8 | Aug. | 29 | 24 | 09 | 19.7 | Dec. | 27 | 24 | 09 | 36.7 | Apr. | 26 | 24 | 09 | 53.3 |

Mean Ayanamsa= 23°51′25″.53 for J 2000.0
Mean Ayanamsa= 24°09′01″.66 + precession from 2021.0 to date
Mean Ayanamsa= 24°09′51″.92 + precession from 2022.0 to date
True Ayanamsa= 23°51′25″.53 + precession from 2000.0 to date

**LONGITUDE OF SUN, MOON AND PLANETS, 2022**

APPARENT GEOCENTRIC LONGITUDE FOR $5^h\ 28^m.9$ I.S.T.

| Date | Sun | | | Moon | | | Mercury | | | Venus | | | Mars | | | Jupiter | | | Saturn | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ° | ' | " | ° | ' | " | ° | ' | " | ° | ' | " | ° | ' | " | ° | ' | " | ° | ' | " |
| Jan. 0 | 279 | 30 | 31 | 240 | 31 | 13 | 296 | 44 | 32 | 293 | 45 | 58 | 252 | 23 | 17 | 330 | 21 | 04 | 311 | 47 | 42 |
| 1 | 280 | 31 | 41 | 255 | 28 | 04 | 298 | 10 | 54 | 293 | 17 | 43 | 253 | 05 | 55 | 330 | 32 | 45 | 311 | 54 | 10 |
| 2 | 281 | 32 | 52 | 270 | 35 | 49 | 299 | 35 | 14 | 292 | 47 | 42 | 253 | 48 | 35 | 330 | 44 | 31 | 312 | 00 | 41 |
| 3 | 282 | 34 | 03 | 285 | 45 | 21 | 300 | 57 | 07 | 292 | 16 | 05 | 254 | 31 | 18 | 330 | 56 | 23 | 312 | 07 | 14 |
| 4 | 283 | 35 | 14 | 300 | 46 | 38 | 302 | 16 | 06 | 291 | 43 | 03 | 255 | 14 | 03 | 331 | 08 | 20 | 312 | 13 | 49 |
| 5 | 284 | 36 | 25 | 315 | 30 | 24 | 303 | 31 | 39 | 291 | 08 | 49 | 255 | 56 | 50 | 331 | 20 | 23 | 312 | 20 | 27 |
| 6 | 285 | 37 | 35 | 329 | 49 | 37 | 304 | 43 | 12 | 290 | 33 | 36 | 256 | 39 | 39 | 331 | 32 | 31 | 312 | 27 | 07 |
| 7 | 286 | 38 | 45 | 343 | 40 | 22 | 305 | 50 | 03 | 289 | 57 | 37 | 257 | 22 | 30 | 331 | 44 | 43 | 312 | 33 | 48 |
| 8 | 287 | 39 | 55 | 357 | 01 | 54 | 306 | 51 | 29 | 289 | 21 | 08 | 258 | 05 | 24 | 331 | 57 | 01 | 312 | 40 | 32 |
| 9 | 288 | 41 | 04 | 9 | 56 | 06 | 307 | 46 | 42 | 288 | 44 | 23 | 258 | 48 | 19 | 332 | 09 | 24 | 312 | 47 | 18 |
| 10 | 289 | 42 | 13 | 22 | 26 | 44 | 308 | 34 | 50 | 288 | 07 | 38 | 259 | 31 | 17 | 332 | 21 | 51 | 312 | 54 | 05 |
| 11 | 290 | 43 | 21 | 34 | 38 | 36 | 309 | 15 | 00 | 287 | 31 | 09 | 260 | 14 | 17 | 332 | 34 | 23 | 313 | 00 | 54 |
| 12 | 291 | 44 | 29 | 46 | 36 | 59 | 309 | 46 | 18 | 286 | 55 | 11 | 260 | 57 | 19 | 332 | 46 | 59 | 313 | 07 | 45 |
| 13 | 292 | 45 | 37 | 58 | 27 | 02 | 310 | 07 | 52 | 286 | 19 | 59 | 261 | 40 | 23 | 332 | 59 | 40 | 313 | 14 | 38 |
| 14 | 293 | 46 | 43 | 70 | 13 | 33 | 310 | 18 | 54 | 285 | 45 | 47 | 262 | 23 | 29 | 333 | 12 | 26 | 313 | 21 | 32 |
| 15 | 294 | 47 | 50 | 82 | 00 | 40 | 310 | 18 | 44 | 285 | 12 | 49 | 263 | 06 | 38 | 333 | 25 | 15 | 313 | 28 | 28 |
| 16 | 295 | 48 | 55 | 93 | 51 | 50 | 310 | 06 | 58 | 284 | 41 | 17 | 263 | 49 | 49 | 333 | 38 | 09 | 313 | 35 | 26 |
| 17 | 296 | 50 | 00 | 105 | 49 | 39 | 309 | 43 | 25 | 284 | 11 | 24 | 264 | 33 | 02 | 333 | 51 | 07 | 313 | 42 | 24 |
| 18 | 297 | 51 | 05 | 117 | 55 | 55 | 309 | 08 | 18 | 283 | 43 | 20 | 265 | 16 | 17 | 334 | 04 | 08 | 313 | 49 | 24 |
| 19 | 298 | 52 | 09 | 130 | 11 | 50 | 308 | 22 | 16 | 283 | 17 | 14 | 265 | 59 | 35 | 334 | 17 | 14 | 313 | 56 | 26 |
| 20 | 299 | 53 | 12 | 142 | 38 | 02 | 307 | 26 | 23 | 282 | 53 | 15 | 266 | 42 | 55 | 334 | 30 | 23 | 314 | 03 | 28 |
| 21 | 300 | 54 | 15 | 155 | 15 | 00 | 306 | 22 | 08 | 282 | 31 | 29 | 267 | 26 | 17 | 334 | 43 | 36 | 314 | 10 | 31 |
| 22 | 301 | 55 | 18 | 168 | 03 | 14 | 305 | 11 | 27 | 282 | 12 | 02 | 268 | 09 | 41 | 334 | 56 | 53 | 314 | 17 | 36 |
| 23 | 302 | 56 | 19 | 181 | 03 | 28 | 303 | 56 | 30 | 281 | 54 | 58 | 268 | 53 | 08 | 335 | 10 | 13 | 314 | 24 | 41 |
| 24 | 303 | 57 | 21 | 194 | 16 | 50 | 302 | 39 | 37 | 281 | 40 | 22 | 269 | 36 | 37 | 335 | 23 | 37 | 314 | 31 | 47 |
| 25 | 304 | 58 | 22 | 207 | 44 | 48 | 301 | 23 | 08 | 281 | 28 | 14 | 270 | 20 | 08 | 335 | 37 | 04 | 314 | 38 | 55 |
| 26 | 305 | 59 | 22 | 221 | 28 | 53 | 300 | 09 | 15 | 281 | 18 | 37 | 271 | 03 | 42 | 335 | 50 | 34 | 314 | 46 | 03 |
| 27 | 307 | 00 | 23 | 235 | 30 | 10 | 298 | 59 | 53 | 281 | 11 | 31 | 271 | 47 | 18 | 336 | 04 | 08 | 314 | 53 | 11 |
| 28 | 308 | 01 | 22 | 249 | 48 | 41 | 297 | 56 | 37 | 281 | 06 | 54 | 272 | 30 | 56 | 336 | 17 | 45 | 315 | 00 | 21 |
| 29 | 309 | 02 | 21 | 264 | 22 | 45 | 297 | 00 | 40 | 281 | 04 | 47 | 273 | 14 | 36 | 336 | 31 | 25 | 315 | 07 | 31 |
| 30 | 310 | 03 | 20 | 279 | 08 | 22 | 296 | 12 | 49 | 281 | 05 | 06 | 273 | 58 | 19 | 336 | 45 | 07 | 315 | 14 | 42 |
| 31 | 311 | 04 | 17 | 293 | 59 | 12 | 295 | 33 | 34 | 281 | 07 | 50 | 274 | 42 | 03 | 336 | 58 | 53 | 315 | 21 | 53 |

**LONGITUDE OF SUN, MOON AND PLANETS, 2022**

APPARENT GEOCENTRIC LONGITUDE FOR $5^h\ 28^m.9$ I.S.T.

| Date | Sun | | | Moon | | | Mercury | | | Venus | | | Mars | | | Jupiter | | | Saturn | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ° | ' | " | ° | ' | " | ° | ' | " | ° | ' | " | ° | ' | " | ° | ' | " | ° | ' | " |
| Feb. 1 | 312 | 05 | 14 | 308 | 47 | 13 | 295 | 03 | 05 | 281 | 12 | 56 | 275 | 25 | 50 | 337 | 12 | 42 | 315 | 29 | 04 |
| 2 | 313 | 06 | 09 | 323 | 23 | 49 | 294 | 41 | 17 | 281 | 20 | 19 | 276 | 09 | 38 | 337 | 26 | 33 | 315 | 36 | 16 |
| 3 | 314 | 07 | 04 | 337 | 41 | 21 | 294 | 27 | 57 | 281 | 29 | 58 | 276 | 53 | 29 | 337 | 40 | 26 | 315 | 43 | 28 |
| 4 | 315 | 07 | 57 | 351 | 34 | 24 | 294 | 22 | 42 | 281 | 41 | 49 | 277 | 37 | 21 | 337 | 54 | 22 | 315 | 50 | 40 |
| 5 | 316 | 08 | 49 | 5 | 00 | 22 | 294 | 25 | 06 | 281 | 55 | 47 | 278 | 21 | 15 | 338 | 08 | 21 | 315 | 57 | 51 |
| 6 | 317 | 09 | 39 | 17 | 59 | 30 | 294 | 34 | 40 | 282 | 11 | 49 | 279 | 05 | 11 | 338 | 22 | 21 | 316 | 05 | 03 |
| 7 | 318 | 10 | 28 | 30 | 34 | 23 | 294 | 50 | 53 | 282 | 29 | 51 | 279 | 49 | 09 | 338 | 36 | 24 | 316 | 12 | 15 |
| 8 | 319 | 11 | 16 | 42 | 49 | 14 | 295 | 13 | 15 | 282 | 49 | 50 | 280 | 33 | 09 | 338 | 50 | 29 | 316 | 19 | 26 |
| 9 | 320 | 12 | 02 | 54 | 49 | 17 | 295 | 41 | 16 | 283 | 11 | 42 | 281 | 17 | 11 | 339 | 04 | 36 | 316 | 26 | 38 |
| 10 | 321 | 12 | 47 | 66 | 40 | 06 | 296 | 14 | 30 | 283 | 35 | 23 | 282 | 01 | 15 | 339 | 18 | 45 | 316 | 33 | 49 |
| 11 | 322 | 13 | 30 | 78 | 27 | 15 | 296 | 52 | 31 | 284 | 00 | 50 | 282 | 45 | 20 | 339 | 32 | 55 | 316 | 40 | 60 |
| 12 | 323 | 14 | 11 | 90 | 15 | 53 | 297 | 34 | 53 | 284 | 27 | 57 | 283 | 29 | 28 | 339 | 47 | 08 | 316 | 48 | 10 |
| 13 | 324 | 14 | 51 | 102 | 10 | 31 | 298 | 21 | 16 | 284 | 56 | 43 | 284 | 13 | 37 | 340 | 01 | 22 | 316 | 55 | 20 |
| 14 | 325 | 15 | 30 | 114 | 14 | 44 | 299 | 11 | 20 | 285 | 27 | 03 | 284 | 57 | 49 | 340 | 15 | 37 | 317 | 02 | 29 |
| 15 | 326 | 16 | 07 | 126 | 31 | 07 | 300 | 04 | 47 | 285 | 58 | 54 | 285 | 42 | 02 | 340 | 29 | 54 | 317 | 09 | 38 |
| 16 | 327 | 16 | 42 | 139 | 01 | 04 | 301 | 01 | 19 | 286 | 32 | 13 | 286 | 26 | 17 | 340 | 44 | 13 | 317 | 16 | 46 |
| 17 | 328 | 17 | 16 | 151 | 44 | 58 | 302 | 00 | 44 | 287 | 06 | 56 | 287 | 10 | 34 | 340 | 58 | 33 | 317 | 23 | 53 |
| 18 | 329 | 17 | 48 | 164 | 42 | 13 | 303 | 02 | 47 | 287 | 43 | 00 | 287 | 54 | 53 | 341 | 12 | 54 | 317 | 30 | 59 |
| 19 | 330 | 18 | 19 | 177 | 51 | 42 | 304 | 07 | 18 | 288 | 20 | 22 | 288 | 39 | 13 | 341 | 27 | 16 | 317 | 38 | 04 |
| 20 | 331 | 18 | 48 | 191 | 12 | 05 | 305 | 14 | 06 | 288 | 58 | 59 | 289 | 23 | 36 | 341 | 41 | 39 | 317 | 45 | 09 |
| 21 | 332 | 19 | 16 | 204 | 42 | 16 | 306 | 23 | 01 | 289 | 38 | 48 | 290 | 08 | 01 | 341 | 56 | 03 | 317 | 52 | 12 |
| 22 | 333 | 19 | 43 | 218 | 21 | 37 | 307 | 33 | 56 | 290 | 19 | 46 | 290 | 52 | 27 | 342 | 10 | 29 | 317 | 59 | 14 |
| 23 | 334 | 20 | 08 | 232 | 09 | 58 | 308 | 46 | 44 | 291 | 01 | 51 | 291 | 36 | 56 | 342 | 24 | 55 | 318 | 06 | 15 |
| 24 | 335 | 20 | 32 | 246 | 07 | 25 | 310 | 01 | 17 | 291 | 44 | 60 | 292 | 21 | 26 | 342 | 39 | 23 | 318 | 13 | 16 |
| 25 | 336 | 20 | 55 | 260 | 13 | 58 | 311 | 17 | 30 | 292 | 29 | 09 | 293 | 05 | 59 | 342 | 53 | 51 | 318 | 20 | 14 |
| 26 | 337 | 21 | 17 | 274 | 28 | 49 | 312 | 35 | 19 | 293 | 14 | 17 | 293 | 50 | 33 | 343 | 08 | 20 | 318 | 27 | 12 |
| 27 | 338 | 21 | 37 | 288 | 49 | 60 | 313 | 54 | 39 | 294 | 00 | 22 | 294 | 35 | 09 | 343 | 22 | 49 | 318 | 34 | 08 |
| 28 | 339 | 21 | 55 | 303 | 13 | 56 | 315 | 15 | 25 | 294 | 47 | 19 | 295 | 19 | 47 | 343 | 37 | 19 | 318 | 41 | 03 |

**LONGITUDE OF SUN, MOON AND PLANETS, 2022**

APPARENT GEOCENTRIC LONGITUDE FOR $5^h\ 28^m.9$ I.S.T.

| Date | | Sun | | | Moon | | | Mercury | | | Venus | | | Mars | | | Jupiter | | | Saturn | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | ° | ' | " | ° | ' | " | ° | ' | " | ° | ' | " | ° | ' | " |
| Mar. | 1 | 340 | 22 | 12 | 317 | 35 | 39 | 316 | 37 | 35 | 295 | 35 | 09 | 296 | 04 | 26 | 343 | 51 | 50 | 318 | 47 | 56 |
| | 2 | 341 | 22 | 28 | 331 | 49 | 15 | 318 | 01 | 06 | 296 | 23 | 47 | 296 | 49 | 07 | 344 | 06 | 21 | 318 | 54 | 47 |
| | 3 | 342 | 22 | 41 | 345 | 48 | 55 | 319 | 25 | 55 | 297 | 13 | 12 | 297 | 33 | 49 | 344 | 20 | 52 | 319 | 01 | 37 |
| | 4 | 343 | 22 | 53 | 359 | 29 | 50 | 320 | 52 | 00 | 298 | 03 | 23 | 298 | 18 | 32 | 344 | 35 | 23 | 319 | 08 | 24 |
| | 5 | 344 | 23 | 03 | 12 | 49 | 00 | 322 | 19 | 20 | 298 | 54 | 17 | 299 | 03 | 17 | 344 | 49 | 54 | 319 | 15 | 10 |
| | 6 | 345 | 23 | 11 | 25 | 45 | 31 | 323 | 47 | 52 | 299 | 45 | 53 | 299 | 48 | 04 | 345 | 04 | 25 | 319 | 21 | 54 |
| | 7 | 346 | 23 | 16 | 38 | 20 | 32 | 325 | 17 | 37 | 300 | 38 | 08 | 300 | 32 | 51 | 345 | 18 | 56 | 319 | 28 | 36 |
| | 8 | 347 | 23 | 20 | 50 | 37 | 01 | 326 | 48 | 32 | 301 | 31 | 03 | 301 | 17 | 40 | 345 | 33 | 27 | 319 | 35 | 16 |
| | 9 | 348 | 23 | 22 | 62 | 39 | 07 | 328 | 20 | 38 | 302 | 24 | 34 | 302 | 02 | 31 | 345 | 47 | 58 | 319 | 41 | 54 |
| | 10 | 349 | 23 | 21 | 74 | 31 | 52 | 329 | 53 | 54 | 303 | 18 | 41 | 302 | 47 | 23 | 346 | 02 | 28 | 319 | 48 | 30 |
| | 11 | 350 | 23 | 19 | 86 | 20 | 41 | 331 | 28 | 20 | 304 | 13 | 23 | 303 | 32 | 16 | 346 | 16 | 59 | 319 | 55 | 03 |
| | 12 | 351 | 23 | 14 | 98 | 11 | 00 | 333 | 03 | 56 | 305 | 08 | 38 | 304 | 17 | 10 | 346 | 31 | 28 | 320 | 01 | 34 |
| | 13 | 352 | 23 | 07 | 110 | 07 | 59 | 334 | 40 | 42 | 306 | 04 | 25 | 305 | 02 | 06 | 346 | 45 | 57 | 320 | 08 | 03 |
| | 14 | 353 | 22 | 58 | 122 | 16 | 10 | 336 | 18 | 37 | 307 | 00 | 42 | 305 | 47 | 03 | 347 | 00 | 26 | 320 | 14 | 30 |
| | 15 | 354 | 22 | 47 | 134 | 39 | 10 | 337 | 57 | 44 | 307 | 57 | 30 | 306 | 32 | 01 | 347 | 14 | 54 | 320 | 20 | 53 |
| | 16 | 355 | 22 | 33 | 147 | 19 | 25 | 339 | 38 | 01 | 308 | 54 | 46 | 307 | 17 | 00 | 347 | 29 | 21 | 320 | 27 | 15 |
| | 17 | 356 | 22 | 18 | 160 | 17 | 56 | 341 | 19 | 30 | 309 | 52 | 30 | 308 | 02 | 01 | 347 | 43 | 47 | 320 | 33 | 33 |
| | 18 | 357 | 22 | 00 | 173 | 34 | 16 | 343 | 02 | 12 | 310 | 50 | 40 | 308 | 47 | 03 | 347 | 58 | 12 | 320 | 39 | 49 |
| | 19 | 358 | 21 | 40 | 187 | 06 | 36 | 344 | 46 | 07 | 311 | 49 | 17 | 309 | 32 | 06 | 348 | 12 | 36 | 320 | 46 | 02 |
| | 20 | 359 | 21 | 19 | 200 | 52 | 11 | 346 | 31 | 16 | 312 | 48 | 19 | 310 | 17 | 10 | 348 | 26 | 59 | 320 | 52 | 13 |
| | 21 | 0 | 20 | 55 | 214 | 47 | 44 | 348 | 17 | 40 | 313 | 47 | 45 | 311 | 02 | 16 | 348 | 41 | 21 | 320 | 58 | 20 |
| | 22 | 1 | 20 | 30 | 228 | 50 | 05 | 350 | 05 | 20 | 314 | 47 | 35 | 311 | 47 | 23 | 348 | 55 | 42 | 321 | 04 | 25 |
| | 23 | 2 | 20 | 03 | 242 | 56 | 30 | 351 | 54 | 16 | 315 | 47 | 47 | 312 | 32 | 31 | 349 | 10 | 02 | 321 | 10 | 27 |
| | 24 | 3 | 19 | 34 | 257 | 04 | 53 | 353 | 44 | 28 | 316 | 48 | 22 | 313 | 17 | 41 | 349 | 24 | 21 | 321 | 16 | 26 |
| | 25 | 4 | 19 | 04 | 271 | 13 | 39 | 355 | 35 | 58 | 317 | 49 | 17 | 314 | 02 | 52 | 349 | 38 | 39 | 321 | 22 | 21 |
| | 26 | 5 | 18 | 32 | 285 | 21 | 29 | 357 | 28 | 46 | 318 | 50 | 33 | 314 | 48 | 03 | 349 | 52 | 54 | 321 | 28 | 14 |
| | 27 | 6 | 17 | 58 | 299 | 26 | 56 | 359 | 22 | 50 | 319 | 52 | 08 | 315 | 33 | 16 | 350 | 07 | 09 | 321 | 34 | 04 |
| | 28 | 7 | 17 | 22 | 313 | 28 | 11 | 1 | 18 | 11 | 320 | 54 | 01 | 316 | 18 | 30 | 350 | 21 | 22 | 321 | 39 | 50 |
| | 29 | 8 | 16 | 44 | 327 | 22 | 52 | 3 | 14 | 48 | 321 | 56 | 13 | 317 | 03 | 44 | 350 | 35 | 33 | 321 | 45 | 32 |
| | 30 | 9 | 16 | 05 | 341 | 08 | 12 | 5 | 12 | 38 | 322 | 58 | 42 | 317 | 48 | 60 | 350 | 49 | 42 | 321 | 51 | 12 |
| | 31 | 10 | 15 | 24 | 354 | 41 | 16 | 7 | 11 | 39 | 324 | 01 | 27 | 318 | 34 | 15 | 351 | 03 | 49 | 321 | 56 | 47 |

**LONGITUDE OF SUN, MOON AND PLANETS, 2022**

APPARENT GEOCENTRIC LONGITUDE FOR $5^h\ 28^m.9$ I.S.T.

| Date | Sun | | | Moon | | | Mercury | | | Venus | | | Mars | | | Jupiter | | | Saturn | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ° | ' | " | ° | ' | " | ° | ' | " | ° | ' | " | ° | ' | " | ° | ' | " | ° | ' | " |
| Apr. 1 | 11 | 14 | 40 | 7 | 59 | 33 | 9 | 11 | 49 | 325 | 04 | 29 | 319 | 19 | 32 | 351 | 17 | 55 | 322 | 02 | 19 |
| 2 | 12 | 13 | 55 | 21 | 01 | 16 | 11 | 13 | 03 | 326 | 07 | 45 | 320 | 04 | 49 | 351 | 31 | 58 | 322 | 07 | 48 |
| 3 | 13 | 13 | 08 | 33 | 45 | 45 | 13 | 15 | 15 | 327 | 11 | 17 | 320 | 50 | 07 | 351 | 45 | 60 | 322 | 13 | 13 |
| 4 | 14 | 12 | 18 | 46 | 13 | 36 | 15 | 18 | 18 | 328 | 15 | 03 | 321 | 35 | 25 | 351 | 59 | 59 | 322 | 18 | 34 |
| 5 | 15 | 11 | 26 | 58 | 26 | 37 | 17 | 22 | 05 | 329 | 19 | 03 | 322 | 20 | 44 | 352 | 13 | 56 | 322 | 23 | 51 |
| 6 | 16 | 10 | 33 | 70 | 27 | 47 | 19 | 26 | 26 | 330 | 23 | 16 | 323 | 06 | 03 | 352 | 27 | 50 | 322 | 29 | 05 |
| 7 | 17 | 09 | 36 | 82 | 20 | 55 | 21 | 31 | 09 | 331 | 27 | 43 | 323 | 51 | 22 | 352 | 41 | 43 | 322 | 34 | 14 |
| 8 | 18 | 08 | 38 | 94 | 10 | 33 | 23 | 36 | 01 | 332 | 32 | 21 | 324 | 36 | 42 | 352 | 55 | 32 | 322 | 39 | 20 |
| 9 | 19 | 07 | 38 | 106 | 01 | 34 | 25 | 40 | 46 | 333 | 37 | 13 | 325 | 22 | 02 | 353 | 09 | 20 | 322 | 44 | 22 |
| 10 | 20 | 06 | 35 | 117 | 59 | 02 | 27 | 45 | 08 | 334 | 42 | 15 | 326 | 07 | 22 | 353 | 23 | 04 | 322 | 49 | 19 |
| 11 | 21 | 05 | 29 | 130 | 07 | 50 | 29 | 48 | 50 | 335 | 47 | 30 | 326 | 52 | 43 | 353 | 36 | 46 | 322 | 54 | 13 |
| 12 | 22 | 04 | 22 | 142 | 32 | 23 | 31 | 51 | 30 | 336 | 52 | 55 | 327 | 38 | 04 | 353 | 50 | 25 | 322 | 59 | 02 |
| 13 | 23 | 03 | 12 | 155 | 16 | 15 | 33 | 52 | 49 | 337 | 58 | 32 | 328 | 23 | 25 | 354 | 04 | 01 | 323 | 03 | 47 |
| 14 | 24 | 01 | 60 | 168 | 21 | 44 | 35 | 52 | 27 | 339 | 04 | 19 | 329 | 08 | 46 | 354 | 17 | 34 | 323 | 08 | 28 |
| 15 | 25 | 00 | 46 | 181 | 49 | 33 | 37 | 50 | 02 | 340 | 10 | 16 | 329 | 54 | 07 | 354 | 31 | 03 | 323 | 13 | 04 |
| 16 | 25 | 59 | 29 | 195 | 38 | 35 | 39 | 45 | 13 | 341 | 16 | 24 | 330 | 39 | 29 | 354 | 44 | 30 | 323 | 17 | 36 |
| 17 | 26 | 58 | 11 | 209 | 45 | 53 | 41 | 37 | 41 | 342 | 22 | 41 | 331 | 24 | 50 | 354 | 57 | 54 | 323 | 22 | 03 |
| 18 | 27 | 56 | 51 | 224 | 07 | 01 | 43 | 27 | 07 | 343 | 29 | 08 | 332 | 10 | 12 | 355 | 11 | 15 | 323 | 26 | 27 |
| 19 | 28 | 55 | 29 | 238 | 36 | 40 | 45 | 13 | 14 | 344 | 35 | 44 | 332 | 55 | 34 | 355 | 24 | 32 | 323 | 30 | 45 |
| 20 | 29 | 54 | 05 | 253 | 09 | 13 | 46 | 55 | 47 | 345 | 42 | 30 | 333 | 40 | 57 | 355 | 37 | 46 | 323 | 34 | 59 |

**SUN AND MOON, 2022**

DECLINATION OF SUN, LATITUDE AND DECLINATION OF MOON FOR $5^h\ 29^m.0$ I.S.T.

| Date | | Declination of Sun | | Latitude of Moon | | Declination of Moon | | Date | | Declination of Sun | | Latitude of Moon | | Declination of Moon | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | ° | ' | ° | ' | | | ° | ' | ° | ' | ° | ' |
| Jan. | 0 | -23 | 5.8 | +0 | 03.8 | 20 | 11.7 | Feb. | 1 | -17 | 10.1 | -4 | 43.5 | 22 | 37.0 |
| | 1 | 23 | 1.2 | -1 | 16.8 | 23 | 55.0 | | 2 | 16 | 53.0 | 5 | 00.1 | 18 | 26.2 |
| | 2 | 22 | 56.2 | 2 | 32.8 | 25 | 59.0 | | 3 | 16 | 35.5 | 4 | 57.5 | 13 | 16.8 |
| | 3 | 22 | 50.6 | 3 | 38.1 | 26 | 7.0 | | 4 | 16 | 17.8 | 4 | 37.0 | 7 | 35.0 |
| | 4 | 22 | 44.7 | 4 | 27.6 | 24 | 20.0 | | 5 | 15 | 59.8 | 4 | 01.7 | -1 | 42.6 |
| | 5 | 22 | 38.2 | 4 | 58.1 | 20 | 55.6 | | 6 | 15 | 41.5 | 3 | 14.7 | +4 | 3.3 |
| | 6 | 22 | 31.4 | 5 | 09.0 | 16 | 20.8 | | 7 | 15 | 22.9 | 2 | 19.5 | 9 | 29.6 |
| | 7 | 22 | 24.1 | 5 | 01.2 | 11 | 3.0 | | 8 | 15 | 4.1 | 1 | 19.1 | 14 | 25.7 |
| | 8 | 22 | 16.3 | 4 | 37.0 | -5 | 24.9 | | 9 | 14 | 45.0 | -0 | 16.3 | 18 | 42.5 |
| | 9 | 22 | 8.1 | 3 | 59.3 | +0 | 16.0 | | 10 | 14 | 25.7 | +0 | 46.3 | 22 | 10.9 |
| | 10 | 21 | 59.5 | 3 | 11.1 | 5 | 46.6 | | 11 | 14 | 6.1 | 1 | 46.6 | 24 | 42.4 |
| | 11 | 21 | 50.4 | 2 | 15.4 | 10 | 56.5 | | 12 | 13 | 46.3 | 2 | 42.3 | 26 | 8.5 |
| | 12 | 21 | 40.9 | 1 | 14.7 | 15 | 36.6 | | 13 | 13 | 26.3 | 3 | 31.3 | 26 | 23.2 |
| | 13 | 21 | 31.0 | -0 | 11.5 | 19 | 37.6 | | 14 | 13 | 6.1 | 4 | 11.4 | 25 | 23.2 |
| | 14 | 21 | 20.7 | +0 | 51.7 | 22 | 50.0 | | 15 | 12 | 45.6 | 4 | 40.5 | 23 | 9.9 |
| | 15 | 21 | 10.0 | 1 | 52.6 | 25 | 4.2 | | 16 | 12 | 25.0 | 4 | 56.7 | 19 | 48.9 |
| | 16 | 20 | 58.9 | 2 | 48.8 | 26 | 11.6 | | 17 | 12 | 4.1 | 4 | 58.6 | 15 | 29.7 |
| | 17 | 20 | 47.3 | 3 | 38.0 | 26 | 6.4 | | 18 | 11 | 43.1 | 4 | 45.3 | 10 | 24.3 |
| | 18 | 20 | 35.4 | 4 | 17.7 | 24 | 46.9 | | 19 | 11 | 21.8 | 4 | 16.6 | +4 | 46.4 |
| | 19 | 20 | 23.1 | 4 | 46.1 | 22 | 16.4 | | 20 | 11 | 0.4 | 3 | 33.6 | -1 | 9.3 |
| | 20 | 20 | 10.4 | 5 | 01.3 | 18 | 42.7 | | 21 | 10 | 38.8 | 2 | 38.0 | 7 | 7.0 |
| | 21 | 19 | 57.3 | 5 | 02.2 | 14 | 16.0 | | 22 | 10 | 17.1 | 1 | 32.7 | 12 | 49.6 |
| | 22 | 19 | 43.8 | 4 | 48.0 | 9 | 8.3 | | 23 | 9 | 55.2 | +0 | 21.2 | 17 | 58.0 |
| | 23 | 19 | 30.0 | 4 | 18.8 | +3 | 32.2 | | 24 | 9 | 33.1 | -0 | 52.4 | 22 | 11.3 |
| | 24 | 19 | 15.8 | 3 | 35.4 | -2 | 19.2 | | 25 | 9 | 10.9 | 2 | 03.6 | 25 | 8.0 |
| | 25 | 19 | 1.3 | 2 | 39.3 | 8 | 11.5 | | 26 | 8 | 48.6 | 3 | 07.8 | 26 | 29.4 |
| | 26 | 18 | 46.4 | 1 | 32.9 | 13 | 48.1 | | 27 | 8 | 26.1 | 4 | 00.5 | 26 | 5.0 |
| | 27 | 18 | 31.2 | +0 | 19.7 | 18 | 49.0 | | 28 | -8 | 3.5 | -4 | 38.1 | 23 | 56.4 |
| | 28 | 18 | 15.6 | -0 | 56.1 | 22 | 50.7 | | | | | | | | |
| | 29 | 17 | 59.7 | 2 | 09.5 | 25 | 28.5 | | | | | | | | |
| | 30 | 17 | 43.5 | 3 | 15.1 | 26 | 22.0 | | | | | | | | |
| | 31 | -17 | 27.0 | -4 | 07.7 | 25 | 22.4 | | | | | | | | |

**SUN AND MOON, 2022**

DECLINATION OF SUN, LATITUDE AND DECLINATION OF MOON FOR $5^h\ 29^m.0$ I.S.T.

| Date | | Declination of Sun | | Latitude of Moon | | Declination of Moon | | Date | | Declination of Sun | | Latitude of Moon | | Declination of Moon | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | ° | ' | ° | ' | | | ° | ' | ° | ' | ° | ' |
| Mar. | 1 | -7 | 40.8 | -4 | 58.1 | 20 | 17.1 | Apr. | 1 | +4 | 26.9 | -3 | 39.2 | -0 | 11.3 |
| | 2 | 7 | 17.9 | 4 | 59.3 | 15 | 28.8 | | 2 | 4 | 50.0 | 2 | 44.4 | +5 | 39.7 |
| | 3 | 6 | 55.0 | 4 | 42.4 | 9 | 55.8 | | 3 | 5 | 13.1 | 1 | 42.3 | 11 | 10.0 |
| | 4 | 6 | 31.9 | 4 | 09.5 | -4 | 00.9 | | 4 | 5 | 36.1 | -0 | 36.4 | 16 | 06.6 |
| | 5 | 6 | 08.8 | 3 | 23.5 | +1 | 56.2 | | 5 | 5 | 58.9 | +0 | 30.1 | 20 | 18.0 |
| | 6 | 5 | 45.6 | 2 | 28.1 | 7 | 39.2 | | 6 | 6 | 21.7 | 1 | 34.2 | 23 | 34.1 |
| | 7 | 5 | 22.3 | 1 | 26.6 | 12 | 55.1 | | 7 | 6 | 44.4 | 2 | 33.6 | 25 | 46.4 |
| | 8 | 4 | 58.9 | -0 | 22.5 | 17 | 32.6 | | 8 | 7 | 06.9 | 3 | 26.2 | 26 | 48.4 |
| | 9 | 4 | 35.5 | +0 | 41.6 | 21 | 22.1 | | 9 | 7 | 29.3 | 4 | 10.1 | 26 | 36.8 |
| | 10 | 4 | 12.0 | 1 | 43.1 | 24 | 14.8 | | 10 | 7 | 51.6 | 4 | 43.6 | 25 | 11.5 |
| | 11 | 3 | 48.5 | 2 | 39.8 | 26 | 03.0 | | 11 | 8 | 13.8 | 5 | 04.9 | 22 | 35.6 |
| | 12 | 3 | 24.9 | 3 | 29.8 | 26 | 40.5 | | 12 | 8 | 35.8 | 5 | 12.7 | 18 | 55.2 |
| | 13 | 3 | 01.3 | 4 | 11.1 | 26 | 03.9 | | 13 | 8 | 57.6 | 5 | 05.5 | 14 | 18.6 |
| | 14 | 2 | 37.6 | 4 | 41.7 | 24 | 13.4 | | 14 | 9 | 19.4 | 4 | 42.4 | 8 | 55.9 |
| | 15 | 2 | 13.9 | 4 | 59.8 | 21 | 12.7 | | 15 | 9 | 40.9 | 4 | 03.2 | +2 | 59.6 |
| | 16 | 1 | 50.2 | 5 | 03.9 | 17 | 09.1 | | 16 | 10 | 02.3 | 3 | 09.0 | -3 | 14.9 |
| | 17 | 1 | 26.5 | 4 | 52.5 | 12 | 12.9 | | 17 | 10 | 23.6 | 2 | 02.1 | 9 | 28.9 |
| | 18 | 1 | 02.8 | 4 | 25.3 | 6 | 36.7 | | 18 | 10 | 44.6 | +0 | 46.4 | 15 | 20.2 |
| | 19 | 0 | 39.1 | 3 | 42.7 | +0 | 35.3 | | 19 | 11 | 05.5 | -0 | 33.2 | 20 | 23.3 |
| | 20 | -0 | 15.4 | 2 | 46.5 | -5 | 34.4 | | 20 | +11 | 26.2 | -1 | 50.9 | -24 | 12.6 |
| | 21 | +0 | 08.3 | 1 | 39.5 | 11 | 33.4 | | | | | | | | |
| | 22 | 0 | 32.0 | +0 | 25.9 | 17 | 00.5 | | | | | | | | |
| | 23 | 0 | 55.7 | -0 | 49.8 | 21 | 33.6 | | | | | | | | |
| | 24 | 1 | 19.3 | 2 | 02.7 | 24 | 50.8 | | | | | | | | |
| | 25 | 1 | 43.0 | 3 | 08.2 | 26 | 34.1 | | | | | | | | |
| | 26 | 2 | 06.5 | 4 | 02.1 | 26 | 33.7 | | | | | | | | |
| | 27 | 2 | 30.1 | 4 | 41.3 | 24 | 50.8 | | | | | | | | |
| | 28 | 2 | 53.6 | 5 | 03.3 | 21 | 37.0 | | | | | | | | |
| | 29 | 3 | 17.0 | 5 | 07.4 | 17 | 11.2 | | | | | | | | |
| | 30 | 3 | 40.4 | 4 | 53.5 | 11 | 54.6 | | | | | | | | |
| | 31 | +4 | 03.7 | -4 | 23.3 | 6 | 08.3 | | | | | | | | |

**PLANETS, 2022**

GEOCENTRIC LATITUDE AND DECLINATION FOR $5^h\ 29^m.0$ I.S.T.

| Date | Mercury Latitude | Mercury Declination | Venus Latitude | Venus Declination | Mars Latitude | Mars Declination | Jupiter Latitude | Jupiter Declination | Saturn Latitude | Saturn Declination |
|---|---|---|---|---|---|---|---|---|---|---|
| | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' |
| Jan. 0 | -1 54.6 | -22 40.8 | +2 37.4 | -18 45.7 | -0 07.3 | -22 23.9 | -0 59.9 | -12 16.9 | -0 49.4 | -18 02.4 |
| 2 | 1 43.1 | 21 55.0 | 3 08.7 | 18 24.6 | 0 08.6 | 22 35.9 | 0 59.7 | 12 08.4 | 0 49.4 | 17 58.8 |
| 4 | 1 28.2 | 21 05.1 | 3 39.4 | 18 4.43 | 0 09.9 | 22 47 | 0 59.6 | 11 59.8 | 0 49.5 | 17 55.2 |
| 6 | 1 09.5 | 20 12.4 | 4 09.2 | 17 45.5 | 0 11.2 | 22 57.3 | 0 59.5 | 11 51.1 | 0 49.6 | 17 51.5 |
| 8 | 0 46.7 | 19 18.7 | 4 37.3 | 17 27.9 | 0 12.6 | 23 6.79 | 0 59.3 | 11 42.2 | 0 49.6 | 17 47.8 |
| 10 | -0 19.8 | 18 26.0 | 5 03.5 | 17 11.8 | 0 14.0 | 23 15.4 | 0 59.2 | 11 33.2 | 0 49.7 | 17 44.0 |
| 12 | +0 11.3 | 17 37.2 | 5 27.1 | 16 57.4 | 0 15.3 | 23 23 | 0 59.1 | 11 24.0 | 0 49.8 | 17 40.2 |
| 14 | 0 45.8 | 16 55.2 | 5 47.9 | 16 44.8 | 0 16.7 | 23 29.8 | 0 59 | 11 14.7 | 0 49.9 | 17 36.4 |
| 16 | 1 22.6 | 16 22.9 | 6 05.7 | 16 34.1 | 0 18.1 | 23 35.7 | 0 58.9 | 11 05.3 | 0 50.0 | 17 32.5 |
| 18 | 1 59.6 | 16 02.7 | 6 20.4 | 16 25.4 | 0 19.5 | 23 40.6 | 0 58.8 | 10 55.8 | 0 50.0 | 17 28.5 |
| 20 | 2 34.0 | 15 55.6 | 6 31.9 | 16 18.7 | 0 20.9 | 23 44.7 | 0 58.7 | 10 46.1 | 0 50.1 | 17 24.5 |
| 22 | 3 02.5 | 16 01.0 | 6 40.4 | 16 13.9 | 0 22.3 | 23 47.8 | 0 58.6 | 10 36.3 | 0 50.2 | 17 20.5 |
| 24 | 3 22.6 | 16 16.5 | 6 46.0 | 16 11 | 0 23.7 | 23 49.9 | 0 58.6 | 10 26.5 | 0 50.3 | 17 16.5 |
| 26 | 3 32.7 | 16 39.0 | 6 48.9 | 16 9.88 | 0 25.1 | 23 51.1 | 0 58.5 | 10 16.5 | 0 50.5 | 17 12.4 |
| 28 | 3 33.1 | 17 05.4 | 6 49.4 | 16 10.3 | 0 26.5 | 23 51.4 | 0 58.4 | 10 06.4 | 0 50.6 | 17 08.3 |
| 30 | 3 25.1 | 17 32.9 | 6 47.8 | 16 12.1 | 0 28.0 | 23 50.6 | 0 58.4 | 9 56.2 | 0 50.7 | 17 04.2 |
| Feb. 1 | 3 10.7 | 17 59.6 | 6 44.3 | 16 15 | 0 29.4 | 23 49 | 0 58.4 | 9 45.9 | 0 50.8 | 17 00.1 |
| 3 | 2 52.0 | 18 24.2 | 6 39.0 | 16 18.8 | 0 30.9 | 23 46.3 | 0 58.3 | 9 35.6 | 0 50.9 | 16 55.9 |
| 5 | 2 30.5 | 18 45.8 | 6 32.4 | 16 23.3 | 0 32.3 | 23 42.7 | 0 58.3 | 9 25.1 | 0 51.1 | 16 51.8 |
| 7 | 2 07.7 | 19 03.8 | 6 24.5 | 16 28.2 | 0 33.8 | 23 38.2 | 0 58.3 | 9 14.6 | 0 51.2 | 16 47.6 |
| 9 | 1 44.3 | 19 17.7 | 6 15.5 | 16 33.3 | 0 35.3 | 23 32.6 | 0 58.3 | 9 04.0 | 0 51.3 | 16 43.4 |
| 11 | 1 21.1 | 19 27.2 | 6 05.5 | 16 38.4 | 0 36.7 | 23 26.1 | 0 58.3 | 8 53.3 | 0 51.5 | 16 39.2 |
| 13 | 0 58.4 | 19 32.1 | 5 54.8 | 16 43.3 | 0 38.2 | 23 18.7 | 0 58.3 | 8 42.6 | 0 51.6 | 16 35.0 |
| 15 | 0 36.6 | 19 32.2 | 5 43.4 | 16 47.8 | 0 39.7 | 23 10.3 | 0 58.3 | 8 31.8 | 0 51.8 | 16 30.8 |
| 17 | +0 15.7 | 19 27.3 | 5 31.4 | 16 51.7 | 0 41.2 | 23 0.91 | 0 58.3 | 8 20.9 | 0 52.0 | 16 26.6 |
| 19 | -0 04.0 | 19 17.4 | 5 19.0 | 16 54.7 | 0 42.7 | 22 50.6 | 0 58.3 | 8 10.0 | 0 52.1 | 16 22.5 |
| 21 | 0 22.5 | 19 02.4 | 5 06.2 | 16 56.8 | 0 44.1 | 22 39.4 | 0 58.4 | 7 59.1 | 0 52.3 | 16 18.3 |
| 23 | 0 39.8 | 18 42.2 | 4 53.2 | 16 57.8 | 0 45.6 | 22 27.2 | 0 58.4 | 7 48.1 | 0 52.5 | 16 14.1 |
| 25 | 0 55.7 | 18 16.9 | 4 39.9 | 16 57.5 | 0 47.1 | 22 14.1 | 0 58.4 | 7 37.0 | 0 52.7 | 16 10.0 |
| 27 | -1 10.3 | -17 46.4 | +4 26.4 | 16 55.9 | -0 48.6 | 22 0.1 | -0 58.5 | 7 26.0 | -0 52.8 | -16 05.9 |

**PLANETS, 2022**

GEOCENTRIC LATITUDE AND DECLINATION FOR $5^h\ 29^m.0$ I.S.T.

| Date | Mercury | | Venus | | Mars | | Jupiter | | Saturn | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Latitude | Declination | Latitude | Declination | Latitude | Declination | Latitude | Declination | Latitude | Declination |
| | ° ' | ° | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' |
| Feb. 27 | -1 10.3 | -17 46.4 | +4 26.4 | -16 55.9 | -0 48.6 | 22 00.1 | -0 58.5 | 7 26.0 | -0 52.8 | -16 05.9 |
| Mar. 1 | 1 23.5 | 17 10.8 | 4 12.8 | 16 52.8 | 0 50.1 | 21 45.2 | 0 58.6 | 7 14.9 | 0 53.0 | 16 01.8 |
| 3 | 1 35.3 | 16 30.0 | 3 59.2 | 16 48.2 | 0 51.6 | 21 29.4 | 0 58.6 | 7 03.7 | 0 53.2 | 15 57.7 |
| 5 | 1 45.6 | 15 44.1 | 3 45.5 | 16 41.9 | 0 53.1 | 21 12.8 | 0 58.7 | 6 52.6 | 0 53.4 | 15 53.6 |
| 7 | 1 54.5 | 14 53.1 | 3 31.8 | 16 33.9 | 0 54.6 | 20 55.2 | 0 58.8 | 6 41.4 | 0 53.6 | 15 49.6 |
| 9 | 2 01.8 | 13 57.1 | 3 18.1 | 16 24.2 | 0 56.1 | 20 36.9 | 0 58.9 | 6 30.3 | 0 53.9 | 15 45.6 |
| 11 | 2 07.5 | 12 56.1 | 3 04.6 | 16 12.7 | 0 57.6 | 20 17.7 | 0 59.0 | 6 19.1 | 0 54.1 | 15 41.7 |
| 13 | 2 11.6 | 11 50.1 | 2 51.1 | 15 59.3 | 0 59.0 | 19 57.7 | 0 59.1 | 6 07.9 | 0 54.3 | 15 37.8 |
| 15 | 2 14.0 | 10 39.2 | 2 37.7 | 15 44.2 | 1 00.5 | 19 36.9 | 0 59.2 | 5 56.7 | 0 54.5 | 15 33.9 |
| 17 | 2 14.6 | 9 23.5 | 2 24.5 | 15 27.1 | 1 02.0 | 19 15.3 | 0 59.3 | 5 45.6 | 0 54.8 | 15 30.1 |
| 19 | 2 13.5 | 8 03.0 | 2 11.4 | 15 08.2 | 1 03.4 | 18 53.0 | 0 59.5 | 5 34.4 | 0 55.0 | 15 26.3 |
| 21 | 2 10.4 | 6 37.7 | 1 58.6 | 14 47.5 | 1 04.9 | 18 29.9 | 0 59.6 | 5 23.3 | 0 55.2 | 15 22.6 |
| 23 | 2 05.5 | 5 07.9 | 1 45.9 | 14 24.8 | 1 06.4 | 18 06.1 | 0 59.7 | 5 12.2 | 0 55.5 | 15 19.0 |
| 25 | 1 58.5 | 3 33.7 | 1 33.5 | 14 00.3 | 1 07.8 | 17 41.6 | 0 59.9 | 5 01.1 | 0 55.7 | 15 15.4 |
| 27 | 1 49.5 | 1 55.3 | 1 21.3 | 13 34.1 | 1 09.2 | 17 16.4 | 1 00.1 | 4 50.1 | 0 56.0 | 15 11.9 |
| 29 | 1 38.5 | -0 12.9 | 1 09.4 | 13 06.0 | 1 10.7 | 16 50.6 | 1 00.2 | 4 39.0 | 0 56.3 | 15 08.4 |
| 31 | 1 25.3 | +1 32.9 | 0 57.8 | 12 36.2 | 1 12.1 | 16 24.1 | 1 00.4 | 4 28.1 | 0 56.5 | 15 05.0 |
| Apr. 2 | 1 10.2 | 3 21.7 | 0 46.5 | 12 04.7 | 1 13.5 | 15 57.0 | 1 00.6 | 4 17.1 | 0 56.8 | 15 01.7 |
| 4 | 0 53.0 | 5 12.7 | 0 35.5 | 11 31.6 | 1 14.9 | 15 29.3 | 1 00.8 | 4 06.3 | 0 57.1 | 14 58.5 |
| 6 | 0 34.1 | 7 04.9 | 0 24.8 | 10 56.9 | 1 16.2 | 15 01.0 | 1 01.0 | 3 55.4 | 0 57.4 | 14 55.3 |
| 8 | -0 13.6 | 8 57.1 | 0 14.4 | 10 20.7 | 1 17.6 | 14 32.2 | 1 01.2 | 3 44.7 | 0 57.6 | 14 52.2 |
| 10 | +0 08.0 | 10 47.9 | +0 04.4 | 9 43.0 | 1 18.9 | 14 02.8 | 1 01.4 | 3 34.0 | 0 57.9 | 14 49.2 |
| 12 | 0 30.2 | 12 35.5 | -0 05.3 | 9 04.0 | 1 20.2 | 13 33.0 | 1 01.6 | 3 23.4 | 0 58.2 | 14 46.3 |
| 14 | 0 52.6 | 14 18.4 | 0 14.6 | 8 23.6 | 1 21.6 | 13 02.6 | 1 01.9 | 3 12.8 | 0 58.5 | 14 43.5 |
| 16 | 1 14.4 | 15 54.7 | 0 23.6 | 7 42.0 | 1 22.8 | 12 31.8 | 1 02.1 | 3 02.4 | 0 58.8 | 14 40.8 |
| 18 | 1 35.1 | 17 23.2 | 0 32.2 | 6 59.2 | 1 24.1 | 12 00.6 | 1 02.4 | 2 52.0 | 0 59.2 | 14 38.2 |
| 20 | +1 53.9 | 18 42.6 | -0 40.4 | 6 15.3 | -1 25.4 | 11 29.0 | -1 02.6 | 2 41.7 | -0 59.5 | -14 35.6 |

## URANUS, NEPTUNE AND PLUTO, 2022

APPARENT GEOCENTRIC LONGITUDE FOR $5^h\ 29^m.0$ I.S.T.

| Date | | Uranus | | | Neptune | | | Pluto | | | Date | | Uranus | | | Neptune | | | Pluto | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ' | " | ° | ' | " | ° | ' | " | | | ° | ' | " | ° | ' | " | ° | ' | " |
| Jan. | 0 | 40 | 58 | 05 | 350 | 39 | 08 | 295 | 54 | 09 | Feb. | 25 | 41 | 24 | 58 | 352 | 15 | 12 | 297 | 40 | 06 |
| | 2 | 40 | 56 | 17 | 350 | 41 | 12 | 295 | 58 | 00 | | 27 | 41 | 28 | 47 | 352 | 19 | 38 | 297 | 43 | 20 |
| | 4 | 40 | 54 | 41 | 350 | 43 | 24 | 296 | 01 | 53 | Mar. | 1 | 41 | 32 | 47 | 352 | 24 | 06 | 297 | 46 | 29 |
| | 6 | 40 | 53 | 16 | 350 | 45 | 43 | 296 | 05 | 48 | | 3 | 41 | 36 | 56 | 352 | 28 | 36 | 297 | 49 | 33 |
| | 8 | 40 | 52 | 04 | 350 | 48 | 09 | 296 | 09 | 43 | | 5 | 41 | 41 | 15 | 352 | 33 | 06 | 297 | 52 | 32 |
| | 10 | 40 | 51 | 03 | 350 | 50 | 43 | 296 | 13 | 39 | | 7 | 41 | 45 | 44 | 352 | 37 | 38 | 297 | 55 | 27 |
| | 12 | 40 | 50 | 15 | 350 | 53 | 23 | 296 | 17 | 36 | | 9 | 41 | 50 | 23 | 352 | 42 | 10 | 297 | 58 | 16 |
| | 14 | 40 | 49 | 40 | 350 | 56 | 10 | 296 | 21 | 34 | | 11 | 41 | 55 | 10 | 352 | 46 | 43 | 298 | 1 | 01 |
| | 16 | 40 | 49 | 17 | 350 | 59 | 04 | 296 | 25 | 32 | | 13 | 42 | 0 | 7 | 352 | 51 | 17 | 298 | 3 | 40 |
| | 18 | 40 | 49 | 07 | 351 | 2 | 05 | 296 | 29 | 30 | | 15 | 42 | 5 | 11 | 352 | 55 | 50 | 298 | 6 | 13 |
| | 20 | 40 | 49 | 09 | 351 | 5 | 11 | 296 | 33 | 27 | | 17 | 42 | 10 | 24 | 353 | 0 | 23 | 298 | 8 | 41 |
| | 22 | 40 | 49 | 24 | 351 | 8 | 24 | 296 | 37 | 25 | | 19 | 42 | 15 | 44 | 353 | 4 | 56 | 298 | 11 | 03 |
| | 24 | 40 | 49 | 51 | 351 | 11 | 42 | 296 | 41 | 21 | | 21 | 42 | 21 | 12 | 353 | 9 | 28 | 298 | 13 | 19 |
| | 26 | 40 | 50 | 31 | 351 | 15 | 07 | 296 | 45 | 17 | | 23 | 42 | 26 | 48 | 353 | 13 | 59 | 298 | 15 | 29 |
| | 28 | 40 | 51 | 24 | 351 | 18 | 36 | 296 | 49 | 12 | | 25 | 42 | 32 | 31 | 353 | 18 | 29 | 298 | 17 | 34 |
| | 30 | 40 | 52 | 29 | 351 | 22 | 12 | 296 | 53 | 06 | | 27 | 42 | 38 | 20 | 353 | 22 | 58 | 298 | 19 | 32 |
| Feb. | 1 | 40 | 53 | 47 | 351 | 25 | 53 | 296 | 56 | 59 | | 29 | 42 | 44 | 16 | 353 | 27 | 25 | 298 | 21 | 24 |
| | 3 | 40 | 55 | 18 | 351 | 29 | 38 | 297 | 00 | 49 | | 31 | 42 | 50 | 18 | 353 | 31 | 50 | 298 | 23 | 09 |
| | 5 | 40 | 57 | 00 | 351 | 33 | 28 | 297 | 04 | 37 | Apr. | 2 | 42 | 56 | 25 | 353 | 36 | 13 | 298 | 24 | 47 |
| | 7 | 40 | 58 | 55 | 351 | 37 | 22 | 297 | 08 | 23 | | 4 | 43 | 2 | 39 | 353 | 40 | 34 | 298 | 26 | 20 |
| | 9 | 41 | 1 | 02 | 351 | 41 | 21 | 297 | 12 | 07 | | 6 | 43 | 8 | 57 | 353 | 44 | 53 | 298 | 27 | 45 |
| | 11 | 41 | 3 | 21 | 351 | 45 | 23 | 297 | 15 | 48 | | 8 | 43 | 15 | 20 | 353 | 49 | 08 | 298 | 29 | 04 |
| | 13 | 41 | 5 | 53 | 351 | 49 | 30 | 297 | 19 | 27 | | 10 | 43 | 21 | 48 | 353 | 53 | 21 | 298 | 30 | 16 |
| | 15 | 41 | 8 | 36 | 351 | 53 | 40 | 297 | 23 | 02 | | 12 | 43 | 28 | 20 | 353 | 57 | 30 | 298 | 31 | 21 |
| | 17 | 41 | 11 | 30 | 351 | 57 | 53 | 297 | 26 | 34 | | 14 | 43 | 34 | 55 | 354 | 1 | 35 | 298 | 32 | 19 |
| | 19 | 41 | 14 | 35 | 352 | 2 | 08 | 297 | 30 | 03 | | 16 | 43 | 41 | 34 | 354 | 5 | 37 | 298 | 33 | 10 |
| | 21 | 41 | 17 | 52 | 352 | 6 | 27 | 297 | 33 | 28 | | 18 | 43 | 48 | 16 | 354 | 9 | 35 | 298 | 33 | 55 |
| | 23 | 41 | 21 | 19 | 352 | 10 | 48 | 297 | 36 | 49 | | 20 | 43 | 55 | 1 | 354 | 13 | 29 | 298 | 34 | 32 |
| | 25 | 41 | 24 | 58 | 352 | 15 | 12 | 297 | 40 | 06 | | 22 | 44 | 1 | 49 | 354 | 17 | 20 | 298 | 35 | 03 |

# EXPLANATION

In the following pages, a short explanation of the terms used in this Ephemeris has been given and the scope and limitations of the information furnished have been stated in a concise form. The values of the different constants and other data upon which the tabulated quantities are based have also been given in some cases in order to facilitate the use of this Ephemeris. It is not intended to furnish here any detailed explanation about the compilation of the tabular matter for which the reader is referred to the relevant literature.

Many changes have been incorporated in this publication from time to time including several recomendations of IAU at its General Assembly.

## THE STANDARD EPOCH AND TIME SCALES

There are two classes of time scales used in Astronomy, one based on the Systeme International (SI) - the atomic second, the other based on the rotation of the Earth. Time scales based on the SI second include TAI and TT for practical applications. Time scale based on the rotation of the Earth include mean and apparent sidereal time and UT1. Because of irregularites in the Earthös rotation and its tidal deceleration, Earthös rotation based time scales do not advance at a uniform rate, and they increasingly lag behind the SI-second-based time scales. The widely disseminated time scale UTC is a hybrid, it advances by SI seconds but is subjct to one-second corrections (leap seconds) to keep it within $0^{s}.9$ of UT1.

The standard epoch J 2000.0 corresponds to 2000 January 1, $12^{h}$ TT (JD 245 1545.0 TT). A date may be expressed in years as a Julian epoch or for some purposes as a Besselian epoch.

Julian epoch = J [2000.0 + (JD − 245 1545.0)/ 365.25]
Where the quantity in the denominator is the Julian year.

Besselian epoch= B [1900.0 + (JD − 241 5020.313 52)/ 365.242 198 781]
Where the quantity in the denominator is the length of tropical year.

Prefixes J and B stand for the Julian and Besselian epochs respectively.

Various time systems used in this publication and their inter-relationships are described below :

**Sidereal time** system is derived from the Earthös rotation with respect to the stars. Local sidereal time is defined as the local hour angle of the vernal equinox. It is $0^{h}$ at the instant when the vernal equinox is at the upper transit of the local meridian. It is determined from observation of meridian transits of known stars. As the equinox oscillates about its mean position due to the effect of nutation, it gives rise to two kinds of sidereal time : the apparent sidereal time which is the hour angle of the true equinox of date and the mean sidereal time which is the hour angle of the mean equinox of date. The relation between the two is:

Apparent sidereal time = Mean sidereal time + Equation of Equinoxes

Equation of equinoxes is the total nutation in longitude multiplied by the cosine of the obliquity of the ecliptic. Its value varies within $\pm$ 1.2 seconds of time in a period of about 18.6 years.

Sidereal time on the geographic meridian of Greenwich is known as Greenwich sidereal time. Local sidereal time is related to Greenwich sidereal time (mean or apparent as appropriate) as follows:

Local sidereal time = Greenwich sidereal time + $\lambda$, where $\lambda$ is the observerös longitude measured positively to the east (from 1985 onwards the sign convention for east terrestrial longitude to be positive has been adopted).

**International Atomic Time (TAI)** is a highly precise time scale given by atomic clocks. It is now being used as a standard in astronomy as it is independent of the Earthös rotation. Its fundamental unit, the SI second, is

defined as the duration of 9 192 631 770 cycles of the radiation corresponding to the transition between two hyperfine levels of the ground state of the Cesium 133 atom. This time scale results from analysis of data from atomic time standards of many countries carried out at the Bureau International de l'Heure in Paris.

**Universal Time (UT)** is used for civil time keeping. It is an outgrowth of the mean solar time system derived from the Earth's rotation with respect to the Sun. It has been formally defined through a strict relationship with the Greenwich mean sidereal time and is, therefore, determined from observation of star transits. The universal time directly derived from observation is designated $UT_o$. It contains nonuniformities due to variations in the rotation of the Earth and is peculiar to the observer's geographic location because of polar motion. When $UT_o$ is corrected for Earth's polar motion, it is called UT1. When UT1 is further corrected for seasonal variation in the Earth's rotation, it is called UT2. Both $UT_o$ and UT2 are not for general usage. Instead, the national time services provide what is known as co-ordinated universal time (UTC). It is a smoothed version of UT2 and differs from TAI by an integral number of seconds. It contains step adjustments of exactly one second (leap seconds) in order to keep it always within 0.90 seconds of UT1. Beginning with 1972, the step adjustments are usually inserted after the $60^{th}$ second of the last minute of December 31 or June 30. In this publication, UT1 has been used in computations relating to hour angles, etc., unless otherwise stated.

**Dynamical Time** replaces ephemeris time (ET) as argument of ephemerides with effect from 1985 in this publication. The concept of different dynamical times for observers in different frames of reference arises out of general theory of relativity. In this publication, terrestrial time (TT) is the tabular argument of the fundamental geocentric ephemerides and barycentric dynamical time (TDB) is the arguments of ephemerides referred to the barycentre of the solar system. The former corresponds to proper time and the latter to co-ordinate time in terms of the general theory of relativity. Both TT and TDB are independent of the Earth's rotation. These scales are so defined that the difference between them is purely periodic. Their difference is given by:-

$TDB = TT + 0^s.001\,657 \sin g + 0^s.000\,022 \sin (L - L_J)$, where higher order terms have been neglected. Here g is the mean anomaly of the Earth in its orbit around the Sun and is given by:-

$$g = 357^\circ.53 + 0^\circ.985\,600\,28\,(JD - 245\,1545.0)$$
$$L - L_J = 246^\circ.11 + 0.902\,517\,92\,(JD - 245\,1545.0)$$

Where $L - L_J$ is the difference in the mean longitude of the Sun and Jupiter.

**Relationship Between universal time and sidereal time**

Universal time is defined in terms of Greenwich mean sidereal time by:

$$\text{GMST at } 0^h \text{ UT1} = 6^h\,41^m\,50^s.549\,377 + 864\,018\,4^s.704\,478\,T_u + 0^s.092\,772\,T_u^2 - 2^s.93 \times 10^{-8}\,T_u^3 - 1^s.997 \times 10^{-6}\,T_u^4 - 2^s.5 \times 10^{-9}\,T_u^5$$

where $T_u$ is the number of Julian centuries of 36525 days of universal time elapsed since 1 January, 2000,$12^h$ UT (JD 245 154 5.0). In other words,

$$T_u = (JD - 245\,1545.0)/\,36525$$

The above expression implies that the ratio of UT1 to GMST at the epoch J2000.0 is 0.997 269 566 329 084 and its inverse is 1.002 737 909 350 795.

The following relationship holds during 2021:

On day of year d at $t^h$ UT1 GMST $= 6^h.658\,8733 + 0^h.065\,709\,8246\,d + 1^h.002\,737\,91\,t$

where day of the year d is tabulated on pages 4 to 12.

In 2021 :

1 mean solar day = 1.002 737 909 35 mean sidereal days
= $24^h\ 03^m\ 56^s.555\ 37$ of mean sidereal time

1 mean sidereal day = 0.997 269 566 33 mean solar days
= $23^h\ 56^m\ 04^s.090\ 53$ of mean solar time

## Conversion of local mean time to local sidereal time

Calculate local sidereal time at $15^h\ 54^m\ 42^s$ L.M.T. on 2021 January 1, for Delhi longitude,

$\lambda = 77°\ 13'\ 00''$ East ( $5^h\ 08^m\ 52^s$ )

| | | h | m | s |
|---|---|---|---|---|
| 1. | Universal time = Local mean time $-\lambda$ | 10 | 45 | 50 |
| 2. | Greenwich mean sidereal time at $0^h$ U.T. on January 1, 2021 (Page 13 ). | 6 | 43 | 28.499 |
| | | h | m | s |
| 3. | Add equivalent mean sidereal time for 10 45 50 (UT × 1.002 737 9093). | 10 | 47 | 36.094 |
| | | ð ð ð | ð ð ð | ð ð ð ð |
| 4. | Greenwich mean sidereal time at desired L.M.T. | 17 | 31 | 4.593185 |
| 5. | Add equation of equinoxes at UT=$0^d$. 45 (second order interpolation may be used). | | | -0.98587 |
| | | ð ð ð | ð ð ð | ð ð ð ð |
| 6. | Greenwich apparent sidereal time | 17 | 31 | 3.607 |
| 7. | Add longitude (east positive) | 5 | 08 | 52.000 |
| | | ð ð ð | ð ð ð | ð ð ð ð |
| 8. | Local apparent sidereal time | 22 | 39 | 55.607 |

For local mean sidereal time, the above process may be repeated by neglecting the equation of equinoxes.

## Conversion of local sidereal time to local mean time

Calculate local mean time at $22^h\ 39^m\ 55^s.607$ local apparent sidereal time on 2021 January 1, for Delhi longitude, $\lambda = 77°\ 13'\ 00''$ East ( $5^h\ 08^m\ 52^s$ )

| | | h | m | s |
|---|---|---|---|---|
| 1. | Local apparent sidereal time | 22 | 39 | 55.607 |
| 2. | Subtract longitude (east positive) | 5 | 08 | 52.000 |
| | | ð ð ð | ð ð ð | ð ð ð ð |
| 3. | Greenwich apparent sidereal time | 17 | 31 | 3.607 |
| 4. | Subtract equation of equinox at $0^h$ U.T. | | | -0.988 |
| | | ð ð ð | ð ð ð | ð ð ð ð |
| 5. | Greenwich mean sidereal time (provisional) | 17 | 31 | 4.596 |
| 6. | Subtract Greenwich mean sidereal time at $0^h$ U.T. | 6 | 43 | 28.499 |
| | | ð ð ð | ð ð ð | ð ð ð ð |
| 7. | Mean sidereal time interval (provisional) M.S.T. (P) | 10 | 47 | 36.096 |

| | | | | |
|---|---|---|---|---|
| 7. | Mean sidereal time interval (provisional) M.S.T. (P) | 10 | 47 | 36.096 |
| 8. | Mean time interval in days corresponding to (7) above = (M.S.T. (P) $\times$ 0.997 269 566) = $0^d.45$ (UT). Subtract the increment to equation of equinoxes for $0^d.45$ UT (using second order interpolation) | (-) | | 0.00540 |
| | | ð ð ð ð | ð ð ð | ð ð ð |
| 9. | Mean sidereal time | 10 | 47 | 36.091 |
| 10. | Equivalent UT (MST $\times$ 0.997 269 566) | 10 | 45 | 49.997 |
| 11. | Local mean time = UT + $\lambda$ | 15 | 54 | 41.997 |

The mean time from the local mean sidereal time may be worked out on similar lines as above by neglecting the equation of equinoxes.

**Notation for time-scales and related quantities**

| | |
|---|---|
| UT1 | Universal time (also UT); counted from $0^h$ (mid night); unit is second of mean solar time, affected by iregularities in the Earthôs rate of rotation. |
| UT0 | local approximation to universal time; not corrected for polar motion (rarely used). |
| GMST | Greenwich mean sidereal time; GHA of mean equinox of date. |
| GAST | Greenwich apparent sidereal time; GHA of true Eqinox of date. |
| TAI | international atomic time; unit is the SI second of geoid. |
| UTC | coordinated universal time; differs from TAI by an integral number of seconds, and is the basis of most radio time signals and national and/ or legal time systems. |
| $\Delta$UT | = UT1 – UTC; increment to be applied to UTC to give UT1 |
| TDB | barycentric dynamical time; used as time-scale of ephemerides, referred to the barycentre of the solar system. |
| $T_{eph}$ | the independent variable of the equations of motion used by the JPL ephemerides, in particular DE405/LE405. $T_{eph}$ and TDB may be considered to be equivalent. |
| TT | terrestrial time; used as time-scale of ephemerides for observations from the Earthôs surface (geoid). |
| TT | = TAI + $32^s.184$. |
| $\Delta$T | = TT – UT1; increment to be applied to UT1 to give TT. |
| | = TAI + $32^s.184$ – UT1 |
| $\Delta$AT | = TAI –UT1; increment to be applied to UTC to give TAI; an integral number of seconds. |
| $\Delta$TT | = TT – UTC = $\Delta$AT + $32^s.184$; increment to be applied to UTC to give TT. |
| UT1 - UT0 | = – (x sin $\lambda$ + y cos$\lambda$ ) tan$\phi$/15 |
| | where $\lambda$ and $\phi$ are usual geodetic longitude and latitude of the place, and x and y are the co-ordinates of the pole with respect to the geodetic system, in arcseconds. |
| GAST | = GMST + $\varepsilon_\gamma/15$, $\varepsilon_\gamma$ is equation of equinox. |

In order to convert the tabulations for $0^h$ TT to $0^h$ UT, one may interpolate to $\Delta T\,\delta_{1/2}/h$ where h is the tabular interval and $\delta_{1/2}$ is the first difference of the tabular values.

**REDUCTION OF TIME SCALES, 1620-1644**

**$\Delta$T = ET - UT**

| Year | $\Delta$T | Year | $\Delta$T | Year | $\Delta$T | Year | $\Delta$T | Year | $\Delta$T |
|---|---|---|---|---|---|---|---|---|---|
| | s | | s | | s | | s | | s |
| 1620.0 | + 124 | 1625.0 | + 102 | 1630.0 | + 85 | 1635.0 | + 72 | 1640.0 | + 62 |
| 1621 | 119 | 1626 | 98 | 1631 | 82 | 1636 | 70 | 1641 | 60 |
| 1622 | 115 | 1627 | 95 | 1632 | 79 | 1637 | 67 | 1642 | 58 |
| 1623 | 110 | 1628 | 91 | 1633 | 77 | 1638 | 65 | 1643 | 57 |
| 1624 | + 106 | 1629 | + 88 | 1634 | + 74 | 1639 | + 63 | 1644 | + 55 |

## REDUCTION OF TIME SCALES, 1645-1819

### $\Delta T$ = ET - UT

| Year | $\Delta T$ | Year | $\Delta T$ | Year | $\Delta T$ | Year | $\Delta T$ | Year | $\Delta T$ |
|---|---|---|---|---|---|---|---|---|---|
| | s | | s | | s | | s | | s |
| 1645.0 | + 54 | 1680.0 | + 16 | 1715.0 | + 10 | 1750.0 | + 13 | 1785.0 | + 17 |
| 1646 | 53 | 1681 | 15 | 1716 | 10 | 1751 | 14 | 1786 | 17 |
| 1647 | 51 | 1682 | 14 | 1717 | 11 | 1752 | 14 | 1787 | 17 |
| 1648 | 50 | 1683 | 14 | 1718 | 11 | 1753 | 14 | 1788 | 17 |
| 1649 | 49 | 1684 | 13 | 1719 | 11 | 1754 | 14 | 1789 | 17 |
| 1650.0 | + 48 | 1685.0 | + 12 | 1720.0 | + 11 | 1755.0 | + 14 | 1790.0 | + 17 |
| 1651 | 47 | 1686 | 12 | 1721 | 11 | 1756 | 14 | 1791 | 17 |
| 1652 | 46 | 1687 | 11 | 1722 | 11 | 1757 | 14 | 1792 | 16 |
| 1653 | 45 | 1688 | 11 | 1723 | 11 | 1758 | 15 | 1793 | 16 |
| 1654 | 44 | 1689 | 10 | 1724 | 11 | 1759 | 15 | 1794 | 16 |
| 1655.0 | + 43 | 1690.0 | + 10 | 1725.0 | + 11 | 1760.0 | + 15 | 1795.0 | + 16 |
| 1656 | 42 | 1691 | 10 | 1726 | 11 | 1761 | 15 | 1796 | 15 |
| 1657 | 41 | 1692 | 9 | 1727 | 11 | 1762 | 15 | 1797 | 15 |
| 1658 | 40 | 1693 | 9 | 1728 | 11 | 1763 | 15 | 1798 | 14 |
| 1659 | 38 | 1694 | 9 | 1729 | 11 | 1764 | 15 | 1799 | 14 |
| 1660.0 | + 37 | 1695.0 | + 9 | 1730.0 | + 11 | 1765.0 | + 16 | 1800.0 | + 13.7 |
| 1661 | 36 | 1696 | 9 | 1731 | 11 | 1766 | 16 | 1801 | 13.4 |
| 1662 | 35 | 1697 | 9 | 1732 | 11 | 1767 | 16 | 1802 | 13.1 |
| 1663 | 34 | 1698 | 9 | 1733 | 11 | 1768 | 16 | 1803 | 12.9 |
| 1664 | 33 | 1699 | 9 | 1734 | 12 | 1769 | 16 | 1804 | 12.7 |
| 1665.0 | + 32 | 1700.0 | + 9 | 1735.0 | + 12 | 1770.0 | + 16 | 1805.0 | + 12.6 |
| 1666 | 31 | 1701 | 9 | 1736 | 12 | 1771 | 16 | 1806 | 12.5 |
| 1667 | 30 | 1702 | 9 | 1737 | 12 | 1772 | 16 | 1807 | 12.5 |
| 1668 | 28 | 1703 | 9 | 1738 | 12 | 1773 | 16 | 1808 | 12.5 |
| 1669 | 27 | 1704 | 9 | 1739 | 12 | 1774 | 16 | 1809 | 12.5 |
| 1670.0 | + 26 | 1705.0 | + 9 | 1740.0 | + 12 | 1775.0 | + 17 | 1810.0 | + 12.5 |
| 1671 | 25 | 1706 | 9 | 1741 | 12 | 1776 | 17 | 1811 | 12.5 |
| 1672 | 24 | 1707 | 9 | 1742 | 12 | 1777 | 17 | 1812 | 12.5 |
| 1673 | 23 | 1708 | 10 | 1743 | 12 | 1778 | 17 | 1813 | 12.5 |
| 1674 | 22 | 1709 | 10 | 1744 | 13 | 1779 | 17 | 1814 | 12.5 |
| 1675.0 | + 21 | 1710.0 | + 10 | 1745.0 | + 13 | 1780.0 | + 17 | 1815.0 | + 12.5 |
| 1676 | 20 | 1711 | 10 | 1746 | 13 | 1781 | 17 | 1816 | 12.5 |
| 1677 | 19 | 1712 | 10 | 1747 | 13 | 1782 | 17 | 1817 | 12.4 |
| 1678 | 18 | 1713 | 10 | 1748 | 13 | 1783 | 17 | 1818 | 12.3 |
| 1679 | + 17 | 1714 | + 10 | 1749 | + 13 | 1784 | + 17 | 1819 | + 12.2 |

This table is based on an adopted value of ï 26"/cy$^2$ for the tidal term ($\dot{n}$) in the mean motion of the Moon from the results of analyses of observations of lunar occultations of stars, eclipses of the Sun and transits of Mercury. (see F.R. Stephenson and L.V. Morrison, 1984 *PhD* Trans, R, Soc. London, Ser A, 313, 47-70).

To calculate the values of $\Delta T$ for a different value of the tidal term ($\dot{n}'$), add ï 0.000 091 ($\dot{n}'$ + 26) (year − 1955)$^2$ seconds to the tabulated values of $\Delta T$.

## REDUCTION OF TIME SCALES FROM 1820

**1820 - 1939, $\Delta T$ = ET − UT.**

**From 1940, $\Delta T$ = TDT - UT.**
**2019, $\Delta T$ = TT - UT.**

| Year | $\Delta T$ | Year | $\Delta T$ | Year | $\Delta T$ | Year | $\Delta T$ | Year | $\Delta T$ |
|---|---|---|---|---|---|---|---|---|---|
| | s | | s | | s | | s | | s |
| 1820.0 | + 12.0 | 1860.0 | + 7.88 | 1900.0 | − 2.72 | 1940.0 | + 24.33 | 1980.0 | + 50.54 |
| 1821 | 11.7 | 1861 | 7.82 | 1901 | 1.54 | 1941 | 24.83 | 1981 | 51.38 |
| 1822 | 11.4 | 1862 | 7.54 | 1902 | − 0.02 | 1942 | 25.30 | 1982 | 52.17 |
| 1823 | 11.1 | 1863 | 6.97 | 1903 | + 1.24 | 1943 | 25.70 | 1983 | 52.96 |
| 1824 | 10.6 | 1864 | 6.40 | 1904 | 2.64 | 1944 | 26.24 | 1984 | 53.79 |
| 1825.0 | 10.2 | 1865.0 | 6.02 | 1905.0 | 3.86 | 1945.0 | 26.77 | 1985.0 | 54.34 |
| 1826 | 9.6 | 1866 | 5.41 | 1906 | 5.37 | 1946 | 27.28 | 1986 | 54.87 |
| 1827 | 9.1 | 1867 | 4.10 | 1907 | 6.14 | 1947 | 27.78 | 1987 | 55.32 |
| 1828 | 8.6 | 1868 | 2.92 | 1908 | 7.75 | 1948 | 28.25 | 1988 | 55.82 |
| 1829 | 8.0 | 1869 | 1.82 | 1909 | 9.13 | 1949 | 28.71 | 1989 | 56.30 |
| 1830.0 | + 7.5 | 1870.0 | + 1.61 | 1910.0 | + 10.46 | 1950.0 | + 29.15 | 1990.0 | + 56.86 |
| 1831 | 7.0 | 1871 | + 0.10 | 1911 | 11.53 | 1951 | 29.57 | 1991 | 57.57 |
| 1832 | 6.6 | 1872 | − 1.02 | 1912 | 13.36 | 1952 | 29.97 | 1992 | 58.31 |
| 1833 | 6.3 | 1873 | 1.28 | 1913 | 14.65 | 1953 | 30.36 | 1993 | 58.12 |
| 1834 | 6.0 | 1874 | 2.69 | 1914 | 16.01 | 1954 | 30.72 | 1994 | 59.98 |
| 1835.0 | 5.8 | 1875.0 | 3.24 | 1915.0 | 17.20 | 1955.0 | 31.07 | 1995.0 | 60.78 |
| 1836 | 5.7 | 1876 | 3.64 | 1916 | 18.24 | 1956 | 31.35 | 1996 | 61.63 |
| 1837 | 5.6 | 1877 | 4.54 | 1917 | 19.06 | 1957 | 31.68 | 1997 | 62.29 |
| 1838 | 5.6 | 1878 | 4.71 | 1918 | 20.25 | 1958 | 32.18 | 1998 | 62.97 |
| 1839 | 5.6 | 1879 | 5.11 | 1919 | 20.95 | 1959 | 32.68 | 1999 | 63.47 |
| 1840.0 | + 5.7 | 1880.0 | − 5.40 | 1920.0 | + 21.16 | 1960.0 | + 33.15 | 2000.0 | + 63.83 |
| 1841 | 5.8 | 1881 | 5.42 | 1921 | 22.25 | 1961 | 33.59 | 2001 | 64.09 |
| 1842 | 5.9 | 1882 | 5.20 | 1922 | 22.41 | 1962 | 34.00 | 2002 | 64.30 |
| 1843 | 6.1 | 1883 | 5.46 | 1923 | 23.03 | 1963 | 34.47 | 2003 | 64.47 |
| 1844 | 6.2 | 1884 | 5.46 | 1924 | 23.49 | 1964 | 35.03 | 2004 | 64.57 |
| 1845.0 | 6.3 | 1885.0 | 5.79 | 1925.0 | 23.62 | 1965.0 | 35.73 | 2005 | + 64.69 |
| 1846 | 6.5 | 1886 | 5.63 | 1926 | 23.86 | 1966 | 36.54 | 2006 | 64.85 |
| 1847 | 6.6 | 1887 | 5.64 | 1927 | 24.49 | 1967 | 37.43 | 2007 | 65.15 |
| 1848 | 6.8 | 1888 | 5.80 | 1928 | 24.34 | 1968 | 38.29 | 2008 | 65.46 |
| 1849 | 6.9 | 1889 | 5.66 | 1929 | 24.08 | 1969 | 39.20 | 2009 | 65.78 |
| 1850.0 | + 7.1 | 1890.0 | − 5.87 | 1930.0 | + 24.02 | 1970.0 | + 40.18 | 2010 | + 66.07 |
| 1851 | 7.2 | 1891 | 6.01 | 1931 | 24.00 | 1971 | 41.17 | 2011 | 66.32 |
| 1852 | 7.3 | 1892 | 6.19 | 1932 | 23.87 | 1972 | 42.23 | 2012 | 66.60 |
| 1853 | 7.4 | 1893 | 6.64 | 1933 | 23.95 | 1973 | 43.37 | 2013 | 66.91 |
| 1854 | 7.5 | 1894 | 6.44 | 1934 | 23.86 | 1974 | 44.49 | 2014 | 67.28 |
| 1855.0 | 7.6 | 1895.0 | 6.47 | 1935.0 | 23.93 | 1975.0 | 45.48 | 2015 | 67.64 |
| 1 856 | 7.7 | 1896 | 6.09 | 1936 | 23.73 | 1976 | 46.46 | 2016 | 68.10 |
| 1857 | 7.7 | 1897 | 5.76 | 1937 | 23.92 | 1977 | 47.52 | 2017 | 68.59 |
| 1858 | 7.8 | 1898 | 4.66 | 1938 | 23.96 | 1978 | 48.53 | 2018 | 68.97 |
| 1859 | 7.8 | 1899 | 3.74 | 1939 | 24.02 | 1979 | 49.59 | 2019 | 69.22 |

**Extrapolated Values**

| | | | | | |
|---|---|---|---|---|---|
| 2020 | + 69.40 | 2022 | + 70 | 2024 | + 70 |
| 2021 | + 70 | 2023 | + 70 | | |

**Difference TAI – UTC = ΔAT**

| Date | ΔAT s | Date | ΔAT s | Date | ΔAT s | Date | ΔAT s |
|---|---|---|---|---|---|---|---|
| 1972 Jul.1 | | 1979 Jan.1 | | 1990 Jan.1 | | 1999 Jan. 1 | |
| | + 11.00 | | + 18.00 | | + 25.00 | | + 32.00 |
| 1973 Jan.1 | | 1980 Jan.1 | | 1991 Jan.1 | | 2006 Jan. 1 | |
| | + 12.00 | | + 19.00 | | + 26.00 | | + 33.00 |
| 1974 Jan.1 | | 1981 Jul.1 | | 1992 Jul.1 | | 2009 Jan. 1 | |
| | + 13.00 | | + 20.00 | | + 27. 00 | | + 34.00 |
| 1975 Jan.1 | | 1982 Jul.1 | | 1993 Jul.1 | | 2012 Jul. 1 | |
| | + 14.00 | | + 21.00 | | + 28.00 | | + 35.00 |
| 1976 Jan.1 | | 1983 Jul.1 | | 1994 Jul.1 | | 2015 Jul. 1 | |
| | + 15.00 | | + 22.00 | | + 29.00 | | + 36.00 |
| 1977 Jan.1 | | 1985 Jul.1 | | 1996 Jan.1 | | 2017 Jan. 1 | |
| | + 16.00 | | + 23.00 | | + 30.00 | | + 37.00 |
| 1978 Jan.1 | | 1988 Jan.1 | | 1997 Jul.1 | | In critical cases descend | |
| | + 17.00 | | + 24.00 | | + 31.00 | ΔET | |
| 1979 Jan.1 | | 1990 Jan.1 | | 1999 Jan.1 | | = ΔAT + $32^s.184$ | |
| | | | | | | ΔTT | |

From 1990 onwards, ΔT is for Jan. 1 $0^h$ UTC.

*See page* 2 for a summary of the notation for time-scales.

## Astronomical Reference System and Reference Frames

A reference system is the complete specification of how a celestial coordinate system is to be formed. Both the origin and the orientation of the fundamental planes (or axes) are defined. A reference system also incorporates a specification of the fundamental models needed to construct the system; that is, the basis for the algorithms used to transform between observable quantities and reference data in the system. A reference frame, on the other hand, consists of a set of identifiable fiducial points on the sky along with their coordinates, which serves as the practical realization of a reference system.

For example, the fundamental plane of an astronomical reference system has conventionally been the extension of the Earthôs equatorial plane, at some date, to infinity. Declination is the angular distance north or south of this plane, and right ascension is the angular distance measured eastward along the equator from some defined reference point. This reference point, the right asscension origin, has traditionally been the Equinox: the point at which the Sun, in its yearly circuit of the celestial sphere, crosses the equatorial plane moving from south to north. The Sunôs apparent yearly motion lies in the ecliptic, the plane of the Earthôs orbit. The equinox, therefore, is a direction in the space along the nodal line defined by the intersection of the ecliptic and equatorial planes; equivalently, on the celestial sphere, the equinox is at one of the two intersections of the great circles representing these planes. Because both of these planes are moving, the coordinate systems that they define must have a date associated with them; such a reference system must therefore be specified as ñthe equator and equinox of (some date)ò.

Of course, such a reference system is an idealization, because the theories of motion of the Earth that define how the two planes move are imperfect. In fact, the very definations of these planes are problematic for high precession work. Even if the fundamental planes of a reference system are defined without any reference to the motions of the Earth, there is no way magically to paint them on the celestial sphere at any particular time. Therefore, in practice, we use a specific reference frame - a set of fiducial objects with assigned coordinates - as the practical representation of an astronomical reference system. The scheme is completely analogous to how terrestrial reference systems are established using survey control stations (geodetic reference point) on the Earthôs surface.

Most commonly, a reference frame consists of a catalog of precise positions (and motions, if measurable) of stars or extragalactic objects as seen from the solar system barycenter at a specific epoch (now usually ñJ2000.0ò, which is 12h TT on January 2000). Each objectôs instantaneous position, expressed as right ascension and declination, indicates the objectôs angular distance from the catalogôs equator and origin of right ascension. Any two such objects in the catalog (if they are not coicident or antipodal) therefore uniquely orient a spherical coordinate system on the sky - a reference frame.

# EXPLANATION

A modern astrometric catalog contains data on a large number of objects (N), so the coordinate system is vastly overdetermined. The quality of the reference frame defined by a catalog depends on the extent to which the coordinates of all possible pairs of objects ($N^2/2$) serve to the identical equator and right ascesion origin, within the expected random errors. Typically, every catalog contains systematic errors, that is, errors in position that are similar for objects that are in the same area of the sky, or are of the same magnitude (flux) or color (spectral index). Systematic errors mean that the reference frame is warped, or is effectively different for different classes of objects. Obviously, minimizing systematic errors when a catalog is constructed is at least as important as minimizing the random errors.

To be useful, a reference frame must be implemented at the time of actual observations, and this requires the computation of the apparent coordinates of the catalog objects at arbitrary dates and times. The accuracy with which we know the motions of the objects accross the sky is an essential factor in this computation. Astrometric star catalogs list proper motions, which are the projection of each starõs space motion onto the celestial sphere, expressed as an angular rate in right ascension and declination per unit time. Because the tabulated proper motions are never perfect, any celesial reference frame deteriorates with time. Moreover, systematic errors in the proper motions can produce time-dependent warpings and spurious rotations of the frame. Therefore, the accuracy and consistency of the proper motions are critical to the overall quality, utility, and longevity of reference frames defined by stars. Even reference frames defined by extragalactic objects, which are usually considered to have zero proper motion, may deteriorate, because many of these objects show small apparent motions that are artifacts of their emission mechanisms.

The position of solar system objects can also be used to define a reference frame. For each solar system body involved, an ephemeris is used, which is simply a table of the celestial coordinates of the body as a funtion of time (or an algorithm that yields such a table). A reference frame defined by the ephemerides of one or more solar system bodies is called a dynamical reference frame. Because the ephemerides used incorporate the motion of the Earth as well as that of the other solar system bodies, dynamical reference frames embody in a very fundamental way the moving equator and ecliptic, hence the equinox. They have therefore been used to correct the orientation of star catalog reference frames (the star positions were systematically adjusted) on the basis of simultaneous observations of star and planets. In a sense, the solar system is used as a gyrocompass. However, dynamical reference frames are not very practical for establishing a coordinate system for day to day astronomical observations.

Descriptions of reference frames and reference systems often refer to three coordinate axes, which are simply the set of right-handed cartesian axes that correspond to the usual celestial spherical coordinate system. The xy-plane is the equator, the z-axis points toward the north celestial pole, and the x-axis points toward the origin of right ascension. Although in principal this allows us to specify the position of any celestial object in rectangular coordinates, the distance scale (based on stellar parallaxes) is not established to high precession beyond the solar system. What a reference system actually defines is the way in which the two coventional astronomical angular coordinates, right ascension and declination, overlay real observable points in the sky.

The fundamental celestial reference system for astronomical application is now the International Celestial Reference System (ICRS) as provided in resolution B2 of 1997. The ñrealizationò of of the ICRS, called the International Celestial Reference Frame (ICRF), is a set of high accuracy positions of extragalactic radio sources measured by very long baseline interferometry.

The IAU Working Group on nomenclature for Fundamental Astronomy has recomended the following definations for ICRS and ICRF:

I**nternational Celestial Reference System (ICRS):** The idealized barycetric co-ordinate system to which celestial positions are referred. It is kinematically non-rotating with respect to the ensemble of distant extragalactic objects. It has no intrinsic orientation but was aligned close to the mean equator and dynamical equinox of J2000.0 for continuity with previous fundamental reference systems. Its orientation is independent of epoch, ecliptic or equator and is realized by a list of adopted coordinates of extragalactic sources.

**International Celestial Reference Frame (ICRF):** A set of extragalactic objects whose adopted positions and uncertainties realize the ICRS axes and give the uncertainties of the axes. It is also the name of radio catalogue whose 212 defining sources are currently the most accurate realization of the ICRS. The orientation of the ICRF catalogue was carried over from earlier IERS radio catalogs and was within the errors of the standard stellar and dynamical frames at the time of adoption. Successive revision of the ICRF are intended to minimize rotation from its original orientation.

Some important reference systems and their designations as per IAU 2000 resolution B1.6, B1.7 and B1.8, and IAU 2006 resolutions 1 and 2 are listed below:

(i) Barycentric Celestial Reference System (BCRS): a system of barycentric space-time coordinates for the solar system within the framework of General Relativity. For all practical applications, the BCRS is assumed to be oriented according to the ICRS axes, the directions of which are realized by the International Celestial Reference Frame. The ICRS is not identical to the system defined by the dynamical mean equator and equinox of J2000.0, although the difference in orientation is only about $0''.02$.

(ii) The Geocentric Celestial Reference System (GCRS): is a system of geocentric space-time coordinates within the framework of General Relativity. The directions of the GCRS axes are obtained from those of the BCRS (ICRS) by a relativistic transformation. Positions of stars obtained from ICRS reference data, corrected for proper motion, parallax, light-bending, and aberration (for a geocentric observer) are with respect to the GCRS. The same is true for planetary positions, although the corrections are somewhat different.

(iii) The J2000.0 dynamical reference system: mean equator and equinox of J2000.0; a geocentric system where the origin of right ascension is the intersection of the mean ecliptic and equator of J2000.0; the system in which the IAU 2000 precession-nutation is defined. For precise applications a small rotation (frame bias) should be made to GCRS positions before precession and nutation are applied. The J2000.0 system may also be barycentric, for example as the reference system for catalogues.

(iv) The true system of date (t); true equator and equinox of date: a geocentric system of date, the pole of which is the celestial intermediate pole (CIP), with the origin of right ascension at the equinox on the true equator of date (intermediate equator). It is a system ñbetweenò the GCRS and the Terrestrial Intermediate Reference System that seperates the components labelled precession-nutation and polar motion.

(v) The Celestial Intermediate Reference System (i): the IAU recomended geocentric system of date, the pole of which is the celestial intermediate pole (CIP), with the origin of right ascension at the celestial intermediate origin (CIO) which is located on the intermediate equator (true equator of date). It is a system ñbetweenò (intermeiate) the GCRS and the Terrestrial Intermediate Reference System that seperates the components labelled precession-nutation and polar motion.

## Precession and Nutation

The algorithms for precession were based on the IAU (1976) value for the rate of general precession in ecliptic longitude. Nutation was given by the 1980 IAU Theory of Nutation. However, IAU (1976) rate of precession had been overestimated by approximately 3 milliarcseconds per year. Further observations also revealed periodic errors of a few milliarcseconds in the 1980 IAU Theory of Nutation.

As part of the 2000 IAU resolutions, the IAU 2000A precession-nutation model was introduced, based on an updated value for the rate of precession and a completely new nutation theory. As before, the model actually consists of two parts, a precession algorithm describing the smooth secular motion of the celestial pole and a nutation algorithm describing the small periodic variations in the poleõs position. The precession algorithm consists of short polynomial series for the values of certain angles. The sines and cosines of these angles, in combination, then define the elements of a precession matrix, **P**. The nutation algorithm consists of a rather long series expansion in Fourier terms for the angular offsets, in ecliptic longitude and latitude, of the actual celestial pole (as modeled) from the precession-only pole (true pole - mean pole). The sines and cosines of these offsets, in combination, then define the elements of a nutation matrix, **N.** The **P** and **N** matrices are applied to the coordinates of celestial objects, expressed as 3-vectors, to transform them from the equator and equinox of one epoch to the equator and equinox of another.

## EXPLANATION

A precession transformation is applied to celestial coordinates to convert them from the mean equator and equinox of J2000.0 to the mean equator and equinox of another date, t. Nutation is applied to the resulting coordinates to transform them to the true equator and equinox of t. Generally we will start with celestial coordinates in the GCRS, which are obtained from basic ICRS data by applying the usual algoriths for proper place. Therefore before we apply precession and nutation - we must first apply the frame bias correction to transform the GCRS coordinates to the dynamical mean equator and equinox of J2000.0. Schematically,

GCRS => frame bias = mean equator & equinox of J2000.0 = precession =>

mean equator & equinox of t = nutation => true equator & equinox of t.

The reduction from a geocentric position **r** with respect to the Geocentric Celestial Reference System (GCRS) to a position $\mathbf{r}_t$ with respect to equator and equinox of date, and vice versa, is given by;

$$\mathbf{r}_t = \mathbf{M}\,\mathbf{r} \quad \text{and } \mathbf{r} = \mathbf{M}^{-1}\mathbf{r}_t$$

Using the 4-rotation Fukishma-Williams (F-W) method, the rotation matrix **M** may be witten as

$$\mathbf{M} = \mathbf{N}\,\mathbf{P}\,\mathbf{B}$$

Since the rotation to orient the GCRS to J2000.0 system are small the following approximate matrix **B** is called frame bias matrix, accurate to 2"x $10^{-9}$ (1 x $10^{-14}$ radians), may be used:

$$\mathbf{B} = \begin{bmatrix} 1 & d\alpha_0 & -\xi_0 \\ -d\alpha_0 & 1 & -\eta_0 \\ \xi_0 & \eta_0 & 1 \end{bmatrix}$$

where $d\alpha_0$ = -14.6 mas, $\xi_0$ = -16.6170 mas, and $\eta_0$ = -6.8192 mas, all converted to radians (divide by 206 264 806.247).

## Precession

The time argument T is given by

$$T = (t - 2000.0)/100 = (JD_{TT} - 2451545.0)/36525, \text{ which is a function of TT.}$$

The Capitine *et al.* method, the formulation of which seperates precession of the equator from precession of the ecliptic, is via the precession angles $\chi_A$, $\omega_A$, $\psi_A$, which are

$$\psi_A = 5038''.481\,507\,T - 1''.079\,0069\,T^2 - 0''.001\,140\,45\,T^3 + 0''.000\,132\,851\,T^4 - 9''.51 \times 10^{-8}\,T^5$$

$$\omega_A = \varepsilon_0 - 0''.025\,754\,T + 0''.051\,2623\,T^2 - 0''.007\,725\,03\,T^3 - 0''.000\,000\,467\,T^4 + 33''.37 \times 10^{-8}\,T^5$$

$$\chi_A = 10''.556\,403\,T - 2''.381\,4292\,T^2 - 0''.001\,211\,97\,T^3 + 0''.000\,170\,663\,T^4 - 5''.60 \times 10\text{-}8\,T^5$$

The mean obliquity of the ecliptic at J2000.0 ( or the equivalent TDB date) is $\varepsilon_0$ = 84381".406

(i) A rotation from the mean equator and equinox of J2000.0 to the mean ecliptic and equinox of J2000.0. This is simply a rotation around the x-axis (the direction toward the mean equinox of J2000.0) by the angle $\varepsilon_0$, the mean obliquity of J2000.0. After the rotation, the fundamental plane is the ecliptic of J2000.0

(ii) A rotation around the new z-axis (the direction toward the ecliptic pole of J2000.0) by the angle $-\psi_A$, the amount of precession of the equator from J2000.0 to t.

(iii) A rotation around the new x-axis (the direction along the intersection of the mean equator of t with the ecliptic of J2000.0) by the angle $-\omega_A$, the obliquity of the mean equator of t with respect to the ecliptic of J2000.0. After the rotation, the fundamental plane is the mean equator of t.

(iv) A rotation around the new z-axis ( the direction toward the mean celestial pole of t) by the angle $\chi_A$, accounting for the precession of the ecliptic along the mean equator of t. After the rotation, the new x-axis is in the direction of the mean equinox of date.

$$\mathbf{P} = \begin{bmatrix} C_4C_2 - S_2S_4C_3 & C_4S_2C_1 + S_4C_3C_2C_1 - S_1S_4S_3 & C_4S_2S_1 + S_4C_3C_2S_1 + C_1S_4S_3 \\ -S_4C_2 - S_2C_4C_3 & -S_4S_2C_1 + C_4C_3C_2C_1 - S_1C_4S_3 & -S_4S_2S_1 + C_4C_3C_2S_1 + C_1C_4S_3 \\ S_2S_3 & -S_3C_2C_1 - S_1C_3 & -S_3C_2S_1 + C_3C_1 \end{bmatrix}$$

where $S_1 = \sin \varepsilon_0$ $S_2 = \sin(-\psi_A)$ $S_3 = \sin(-\omega_A)$ $S_4 = \sin \chi_A$
$C_1 = \cos \varepsilon_0$ $C_2 = \cos(-\psi_A)$ $C_3 = \cos(-\omega_A)$ $C_4 = \cos \chi_A$

Existing applications that use the 3-angle precession formulation of Newcomb and Lieske can be easily modified for the IAU 2000A precession, by replacing the current polynomials for the angles $\zeta_{A,}$ $Z_A$ and $\theta_A$ with the following:

$$\zeta_A = 2''.650545 + 2306''.083227\,T + 0''.2988499\,T^2 + 0''.01801828\,T^3 - 0''.000005971\,T^4 - 0''.0000003173\,T^5$$

$$Z_A = -2''.650545 + 2306''.077181\,T + 1''.0927348\,T^2 + 0''.01826837\,T^3 - 0''.000028596\,T^4 - 0''.0000002904\,T^5$$

$$\theta_A = 2004''.191903\,T - 0''.4294934\,T^2 - 0''.04182264\,T^3 - 0''.000007089\,T^4 - 0''.0000001274\,T^5$$

The centennial (per Julian century) rates of general precession in right ascension and declination are given by :

$$m = 4612''.604\,08 + 2''.783\,169\,4\,T + 0''.108\,859\,95\,T^2 - 0''.000\,138\,268\,T^3 \text{ and}$$

$$n = 2004''.191\,903 - 0''.858\,986\,8\,T - 0''.125\,467\,92\,T^2 - 0''.000\,028\,356\,T^3$$

The elements of the matrix **P** given in terms of $\zeta_{A,}$ $Z_{A,}$ $\theta_A$ are as follows:

$$\mathbf{P} = \begin{bmatrix} \cos\zeta_A \cos\theta_A \cos Z_A - \sin\zeta_A \sin Z_A & -\sin\zeta_A \cos\theta_A \cos Z_A - \cos\zeta_A \sin Z_A & -\sin\theta_A \cos Z_A \\ \cos\zeta_A \cos\theta_A \sin Z_A + \sin\zeta_A \cos Z_A & -\sin\zeta_A \cos\theta_A \sin Z_A + \cos\zeta_A \cos Z_A & -\sin\theta_A \sin Z_A \\ \cos\zeta_A \sin\theta_A & -\sin\zeta_A \sin\theta_A & \cos\theta_A \end{bmatrix}$$

The formula for reduction of precession in right ascension and declination are as follows :

$$\begin{aligned} \sin(\alpha - Z_A)\cos\delta &= \sin(\alpha_o + \zeta_A)\cos\delta_o. \\ \cos(\alpha - Z_A)\cos\delta &= \cos(\alpha_o + \zeta_A)\cos\theta_A \cos\delta_o - \sin\theta_A \sin\delta_o \\ \sin\delta &= \cos(\alpha_o + \zeta_A)\sin\theta_A \cos\delta_o + \cos\theta_A \sin\delta_o \end{aligned}$$

$$\begin{aligned} \sin(\alpha_o + \zeta_A)\cos\delta_o &= \sin(\alpha - Z_A)\cos\delta \\ \cos(\alpha_o + \zeta_A)\cos\delta_o &= \cos(\alpha - Z_A)\cos\theta_A \cos\delta + \sin\theta_A \sin\delta \\ \sin\delta_o &= -\cos(\alpha - Z_A)\sin\theta_A \cos\delta + \cos\theta_A \sin\delta \end{aligned}$$

Values of the angles $\zeta_A$, $Z_A$, $\theta_A$ and of the elements of the matrix P for reduction from the standard epoch J 2000.0 to epoch of year are as follows:

Epoch J 2021.5 — Rotation matrix P for reduction to epoch J 2021.5

$$\zeta_A = +498''.472 = +0^\circ.138\,465$$
$$Z_A = +493''.207 = +0^\circ.137\,002$$
$$\theta_A = +430''.881 = +0^\circ.119\,689$$

$$\mathbf{P} = \begin{bmatrix} +0.999\,986\,26 & -0.004\,807\,77 & -0.002\,088\,96 \\ +0.004\,807\,77 & +0.999\,988\,44 & -0.000\,004\,99 \\ +0.002\,088\,96 & -0.000\,005\,05 & +0.999\,997\,82 \end{bmatrix}$$

The obliquity of the ecliptic of date (with respect to the mean equator of date) is given by:

$$\varepsilon = \varepsilon_0 - 46''.836\,769T - 0''.000\,183\,1\,T^2 + 0''.002\,003\,4\,T^3 - 0''.000\,000\,576\,T^4 - 0''.000\,000\,043\,4\,T^5$$

where $\varepsilon_0 = 84381''.406$

The precessional motion of the ecliptic specified by the inclination ($\pi_A$) and longitude of the node ($\Pi_A$) of the ecliptic of date with respect to the ecliptic and equinox of J 2000.0 are given by:

$$\text{Sin}\,\pi_A \sin\Pi_A = +4''.199\,094\,T + 0''.193\,987\,T^2 - 0''.000\,224\,66\,T^3$$
$$\text{Sin}\,\pi_A \cos\Pi_A = -46''.811\,015\,T + 0''.051\,028\,T^2 + 0''.000\,524\,13\,T^3$$

For epoch J 2021.5

$$\varepsilon = 23^\circ\,26'\,11''.34 = 23^\circ.436\,482$$
$$\pi_A = +10''.103 = 0^\circ.002\,806\,5$$
$$\Pi_A = 174^\circ\,49'.3 = 174^\circ.822$$

**Approximate formulae for the reduction of precession** in co-ordinates and orbital elements referred to the mean equinox and equator or ecliptic of date (t) are as follows :

| Reduction to J 2000.0 | Reduction from J 2000.0 |
|---|---|
| $\alpha_o = \alpha - M - N\sin\alpha_m \tan\delta_m$ | $\alpha = \alpha_o + M + N\sin\alpha_m \tan\delta_m$ |
| $\delta_o = \delta - N\cos\alpha_m$ | $\delta = \delta_o + \mathrm{N}\cos\alpha_m$ |
| $\lambda_o = \lambda - a + b\cos(\lambda + c')\tan\beta_o$ | $\lambda = \lambda_o + a - b\cos(\lambda_o + c)\tan\beta$ |
| $\beta_o = \beta - b\sin(\lambda + c')$ | $\beta = \beta_o + b\sin(\lambda_o + c)$ |
| $\Omega_o = \Omega - a + b\sin(\Omega + c')\cot i_o$. | $\Omega = \Omega_o + a - b\sin(\Omega_o + c)\cot i$ |
| $i_o = i - b\cos(\Omega + c')$ | $i = i_o + b\cos(\Omega_o + c)$ |
| $\omega_o = \omega - b\sin(\Omega + c')\,\mathrm{cosec}\, i_o$ | $\omega = \omega_o + b\sin(\Omega_o + c)\,\mathrm{cosec}\, i$ |

The precessional constants M, N etc. are given by :

$$M = 1^\circ.281\,155\,668\,9\,T + 0^\circ.000\,386\,551\,31\,T^2 + 0^\circ.000\,010\,079\,T^3$$
$$N = 0^\circ.556\,719\,973\,1\,T - 0^\circ.000\,119\,303\,72\,T^2 - 0^\circ.000\,011\,617\,4\,T^3$$
$$a = 1^\circ.396\,887\,83\,T + 0^\circ.000\,307\,065\,22\,T^2$$
$$b = 0^\circ.013\,055\,270\,3\,T - 0^\circ.000\,009\,303\,50\,T^2$$
$$c = 5^\circ.125\,890\,67 + 0^\circ.818\,993\,58\,T + 0^\circ.000\,104\,256\,09\,T^2 - 0^\circ.000\,104\,155\,607\,T^3$$
$$c' = 5^\circ.125\,890\,67 - 0^\circ.577\,894\,252\,T - 0^\circ.000\,164\,504\,28\,T^2 - 0^\circ.000\,104\,177\,728\,T^3$$

where $T = (t - 2000.0)/100 = (JD_{TT} - 245\,1545.0)/36525$

Formulae for the reduction from the mean equinox and equator or ecliptic of the middle of year ($t_1$) to date (t) are as follows :

$$\alpha = \alpha_1 + \tau (m + n \sin \alpha_1 \tan \delta_1) \qquad \delta = \delta_1 + \tau n \cos \alpha_1$$
$$\lambda = \lambda_1 + \tau \{p - \pi \cos (\lambda_1 + 6^\circ) \tan \beta\} \qquad \beta = \beta_1 + \tau \pi \sin (\lambda_1 + 6^\circ)$$
$$\Omega = \Omega_1 + \tau \{\rho - \pi \sin (\Omega_1 + 6^\circ) \cot i\} \qquad i = i_1 + \tau \pi \cos (\Omega_1 + 6^\circ)$$
$$\omega = \omega_1 + \tau \pi \sin (\Omega_1 + 6^\circ) \operatorname{cosec} i$$

where $\tau = t - t_1$ and $\pi$ is the annual rate of rotation of the ecliptic. The precessional constants p, m, etc. are as follows :

| | | Epoch J 2021.5 |
|---|---|---|
| Annual general precession | p = | + 0°.013 971 04 |
| Annual precession in R.A. | m = | + 0°.012 813 99 |
| Annual precession in Dec. | n = | + 0°.005 567 02 |
| Annual rate of rotation | $\pi$ = | + 0°.000 130 52 |
| Longitude of axis | $\Pi$ = | + 175°.0728 |

$$\gamma = 180^\circ - \Pi = +4^\circ.9272$$

Where $\Pi$ is the longitude of the instantaneous rotation axis of the ecliptic, measured from the mean equinox of date.

## Nutation

The changes in the amplitudes of the nutation components are also not directly taken from the observations; instead a new nutation theory is developed and fit to observations by allowing a small number of geophysical constants to be free parameters. These parameters are constants in a ñtransfer functionò that modifies the amplitudes of the terms from a rigid- Earth nutation development. Since there are fewer solved-for geophysical constants than the number of terms with observed amplitudes, the fit cannot be perfect. For the IAU 2000A model, 7 geophysical parameters were determined based on the observed amplitudes of 21 nutation terms (prograde and retrograde amplitudes for each) together with the apparent change in the rate of precession in longitude. Note that the number of free parameters in the model are both quite small compared to the 1365 terms in the new, full nutation serirs.

Nutation is conventionally expressed as two small angles, $\Delta\psi$ the nutation in longitude, and $\Delta\varepsilon$, the nutation in obliquity. These angles are measured in the Ecliptic system of date, which is developed as a part of precession formulation. The angle $\Delta\psi$ is the small change in the position of the equinox along the ecliptic due to nutation, so effect of nutation on the ecliptic coordinates of a fixed point in the sky is simply to add $\Delta\psi$ to its ecliptic longitude. The angle $\Delta\varepsilon$ is the small change in the obliquity of the ecliptic due to nutation. The true obliquity of date is $\varepsilon' = \varepsilon + \Delta\varepsilon$. Nutation in obliquity reflects the orientation of the equator in space and does not affect the ecliptic coordinates of a fixed point on the sky.

## Formulas for Nutation

| | |
|---|---|
| $l$ | is the mean anomaly of the Moon. |
| $l'$ | is the mean anomaly of the Sun (Earth). |
| $\Omega$ | is the longitude of the ascending node of the Moonõs mean orbit on the ecliptic, measured from the mean equinox of date. |
| D | is the mean elongation of the Moon from the Sun. |
| F | is the difference $L - \Omega$, where L is the mean longitude of the Moon. |
| $\varepsilon$ | $= \varepsilon_0 - 46''.836\,769\,T - 0''.000\,183\,1\,T^2 + 0''.002\,003\,4\,T^3 - 0''.000\,000\,576\,T^4 - 0''.000\,000\,043\,4\,T^5$ |

where $\varepsilon_0 = 84381''.406$

# EXPLANATION

**The fundamental arguments are given by:**

The five arguments are the same fundamental luni - solar arguments used in previous nutation theories, but with updated expressions.

$l$ = 485 868''. 249 036 + (1325 $^r$ + 715 923''. 2178) T + 31''. 8792 $T^2$ + 0''. 051 635 $T^3$ - 0''.000 244 70 $T^4$

$l'$ = 128 7104''. 793 04 + (99 $^r$ + 129 2581''. 048) Tï 0''. 5532 $T^2$ï 0''. 000 136 $T^3$ - 0''.000 011 49 $T^4$

F = 335 779''. 526 232 + (1342 $^r$ + 295 262''. 8478) Tï 12''. 7512 $T^2$ - 0''. 001 037 $T^3$ + 0''.000 004 17 $T^4$

D = 107 2260''. 703 69 + (1236 $^r$ + 110 5601''. 209) Tï 6''. 3706 $T^2$ + 0''. 006 593 $T^3$ - 0''.000 031 69 $T^4$

$\Omega$ = 450 160''. 398 036ï (5 $^r$ + 482 890''. 5431) T + 7''. 722 $T^2$ + 0''. 007 702 $T^3$ - 0''.000 059 39 $T^4$

where 1 $^r$ = 360° = 129 6000''

**Reduction for nutation - rigorous formulae**

Nutation in longitude ($\Delta\psi$) and obliquity ($\Delta\varepsilon$) have been calculated using IAU 2000A series definitions (order of 1 μas) with the following adjustments which are required for use at the highest precession with the IAU 2006 precession, viz:

$$\Delta\psi = \Delta\psi_{2000A} + (0.4697 \times 10^{-6} - 2.7774 \times 10^{-6} T)\, \Delta\psi_{2000A}$$

$$\Delta\varepsilon = \Delta\varepsilon_{2000A} - 2.7774 \times 10^{-6}\, T\, \Delta\varepsilon_{2000A}$$

where T is measured in Julian centuries from 245 1545.0 TT. $\Delta\psi$ and $\Delta\varepsilon$ together with the true obliquity of the ecliptic ($\varepsilon'$) are tabulated daily at $0^h$ TT, on page 18 to 32.

Once the nutation series has been evaluated and the values of $\Delta\psi$ and $\Delta\varepsilon$ are available, the nutation matrix can be constructed.

A mean place ($\mathbf{r}_m$) may be transformed to a true place ($\mathbf{r}_t$) and vice versa, as follows:

$$\mathbf{r}_t = \mathbf{N}\, \mathbf{r}_m \qquad \mathbf{r}_m = N^{-1}\, \mathbf{r}_t$$

where $\mathbf{N} = \mathbf{R}_1(-\varepsilon')\, \mathbf{R}_3(-\Delta\psi)\, \mathbf{R}_1(+\varepsilon)$

$\varepsilon' = \varepsilon + \Delta\varepsilon$

$\mathbf{R}_1$ and $\mathbf{R}_3$ are the standard rotations about the x and z axes respectively.

(i) A rotation from the mean equator and equinox of t to the mean ecliptic and equinox of t. This is simply a rotation around the x - axis ( the direction toward the mean equinox of t) by the angle $\varepsilon$, the mean obliquity of t.

(ii) A rotation around the new z-axis (the direction toward the ecliptic pole of t) by the angle - $\Delta\psi$, the amount of nutation in longitude at t. After the rotation, the new x- axis is in the direction of true equinox of t.

(iii) A rotation around the new x-axis ( the direction toward true equinox of t by the angle $-\varepsilon'$, the true oliquity of t. After the rotation, the fundamental plane is the true equator of t, orthogonal to the computed position of the CIP at t.

The nutation matrix can be written:

$$\mathbf{N} = \begin{bmatrix} C_2 & S_2C_1 & S_2S_1 \\ -S_2C_3 & C_3C_2C_1 - S_1S_3 & C_3C_2S_1 + C_1S_3 \\ S_2S_3 & -S_3C_2C_1 - S_1C_3 & -S_3C_2S_1 + C_3C_1 \end{bmatrix}$$

where $S_1 = \sin(\varepsilon)$ $\quad S_2 = \sin(-\Delta\psi)$ $\quad S_3 = \sin(-\varepsilon - \Delta\varepsilon)$

$C_1 = \cos(\varepsilon)$ $\quad C_2 = \cos(-\Delta\psi)$ $\quad C_3 = \cos(-\varepsilon - \Delta\varepsilon)$

**Approximate reduction for nutation** for converting mean place to true place can be done with the help of the following formualae :

$\Delta\alpha$ = (cos $\varepsilon$ + sin $\varepsilon$ sin $\alpha$ tan $\delta$) $\Delta\psi$ ï cos $\alpha$ tan $\delta$ $\Delta\varepsilon$

$\Delta\delta$ = sin $\varepsilon$ cos $\alpha$ $\Delta\psi$ + sin $\alpha$ $\Delta\varepsilon$

$\Delta\lambda = \Delta\psi; \qquad \Delta\beta = 0$

where $\Delta\psi$ and $\Delta\varepsilon$ are nutations in longitude and obliquity respectively. Mean rectangular coordinates (x, y, z) can be converted to true rectangular co-ordinates with the help of the following :

$$\Delta x = \text{ï}\ (y \cos\varepsilon + z \sin\varepsilon)\ \Delta\psi$$
$$\Delta y = +\, x\, \Delta\psi \cos\varepsilon\ \text{ï}\ z\, \Delta\varepsilon$$
$$\Delta z = +\, x\, \Delta\psi \sin\varepsilon + y\, \Delta\varepsilon$$

where both $\Delta\psi$ and $\Delta\varepsilon$ are in radians.

The elements of the corresponding rotation matrix are:

$$\mathbf{N} = \begin{bmatrix} 1 & -\Delta\psi\cos\varepsilon & -\Delta\psi\sin\varepsilon \\ +\Delta\psi\cos\varepsilon & 1 & -\Delta\varepsilon \\ +\Delta\psi\sin\varepsilon & +\Delta\varepsilon & 1 \end{bmatrix}$$

Daily values of $\Delta\psi$ and $\Delta\varepsilon$ during 2021 are tabulated on pages 18 to 32.

**Approximate reduction for precession and nutation** in right ascension and declination from the standard equinox and equator of J 2000.0 to the true equinox and equator of date during 2021 can be done using the following formulae and table :

$$\alpha = \alpha_o + f + g \sin(G + \alpha_o) \tan\delta_o$$
$$\delta = \delta_o + g \cos(G + \alpha_o)$$

where the units of the correction to $\alpha_o$ and $\delta_o$ are in second of time and minutes of arc respectively.

| Date | | *f* | *g* | , *g* | *G* | | Date | | *f* | *g* | *g* | *G* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2021 | | s | s | ′ | h | m | 2021 | | s | s | ′ | h | m |
| **Jan.** | **- 4** | + 63.5 | 27.6 | 6.90 | 00 | 00 | **Jul.** | **5** * | + 65.2 | 28.3 | 7.08 | 23 | 59 |
| | **6** | + 63.6 | 27.6 | 6.91 | 00 | 00 | | **15** | + 65.3 | 28.4 | 7.09 | 23 | 59 |
| | **16** | + 63.8 | 27.7 | 6.93 | 00 | 00 | | **25** | + 65.4 | 28.4 | 7.11 | 23 | 59 |
| | **26** * | + 63.8 | 27.7 | 6.94 | 00 | 00 | **Aug.** | **4** | + 65.5 | 28.5 | 7.11 | 23 | 59 |
| **Feb.** | **5** | + 63.9 | 27.8 | 6.94 | 23 | 59 | | **14** * | + 65.6 | 28.5 | 7.12 | 23 | 58 |
| | **15** | + 64.0 | 27.8 | 6.95 | 23 | 59 | | **24** | + 65.7 | 28.5 | 7.13 | 23 | 58 |
| | **25** | + 64.1 | 27.9 | 6.96 | 23 | 59 | **Sep.** | **3** | + 65.7 | 28.6 | 7.14 | 23 | 58 |
| **Mar.** | **7** * | + 64.2 | 27.9 | 6.97 | 23 | 59 | | **13** | + 65.8 | 28.6 | 7.15 | 23 | 58 |
| | **17** | + 64.2 | 27.9 | 6.97 | 23 | 59 | | **23** * | + 65.8 | 28.6 | 7.15 | 23 | 58 |
| | **27** | + 64.3 | 27.9 | 6.98 | 23 | 59 | **Oct.** | **3** | + 65.9 | 28.6 | 7.16 | 23 | 58 |
| **Apr.** | **6** | + 64.4 | 28.0 | 6.99 | 23 | 59 | | **13** | + 66.0 | 28.7 | 7.17 | 23 | 58 |
| | **16** * | + 64.4 | 28.0 | 6.99 | 23 | 59 | | **23** | + 66.0 | 28.7 | 7.17 | 23 | 58 |
| | **26** | + 64.5 | 28.0 | 7.00 | 23 | 59 | **Nov.** | **2** * | + 66.1 | 28.7 | 7.18 | 23 | 58 |
| **May.** | **6** | + 64.6 | 28.1 | 7.02 | 23 | 59 | | **12** | + 66.2 | 28.8 | 7.20 | 23 | 58 |
| | **16** | + 64.7 | 28.1 | 7.02 | 23 | 59 | | **22** | + 66.3 | 28.8 | 7.20 | 23 | 58 |
| | **26** * | + 64.7 | 28.1 | 7.03 | 23 | 59 | **Dec.** | **2** | + 66.4 | 28.9 | 7.21 | 23 | 58 |
| **Jun.** | **5** | + 64.9 | 28.2 | 7.05 | 23 | 59 | | **12** * | + 66.6 | 28.9 | 7.23 | 23 | 58 |
| | **15** | + 65.0 | 28.2 | 7.06 | 23 | 59 | | **22** | + 66.7 | 29.0 | 7.24 | 23 | 58 |
| | **25** | + 65.1 | 28.3 | 7.07 | 23 | 59 | | **32** | + 66.8 | 29.0 | 7.25 | 23 | 58 |
| **Jul.** | **5** * | + 65.2 | 28.3 | 7.08 | 23 | 59 | | **42** | + 66.9 | 29.1 | 7.27 | 23 | 58 |

* 40 - day date    À400 day date for osculation epoch

# EXPLANATION

**Differential Precession and Nutation** can be applied to obtain the differences in the mean place of an object relative to a comparison star for a standard epoch (J 2000.0) using the following formulae:

correction to R.A. : $e \tan\delta\,\Delta\alpha - f \sec^2\delta\,\Delta\delta$

correction to declination : $f\,\Delta\alpha$

where $\Delta\alpha$ and $\Delta\delta$ are the observed differences in right ascension and declination of the object relative to the comparison star and

$e = -\cos\alpha\,(n\,t + \sin\varepsilon\,\Delta\psi) - \sin\alpha\,\Delta\varepsilon$

$f = +\sin\alpha\,(n\,t + \sin\varepsilon\,\Delta\psi) - \cos\alpha\,\Delta\varepsilon$

$\varepsilon = 23^\circ.44,\ \sin\varepsilon = 0.398$

$n = 0.000\,0972$ radian for epoch J 2021.5

$t$ is the time in years from the standard epoch to the time of observation.

$\Delta\psi$, $\Delta\varepsilon$ are nutations in longitude and obliquity at the time of observation expressed in radians, (1" = 0.000 004 8481 rad).

## Aberration

Aberration is the displacement of the position of a celestial object due to finite speed of light. The actual velocity of light in space $c$ is the vectorial sum of its velocity relative to the observer $c_r$ and the velocity $V$ of the observer. Although the special theory of relativity has no provision of breaking up aberration of light into components, total effects of aberration in astronomy are broken into stellar, annual, elliptic, secular and planetary aberration for convenience of computation. In case of stars, all that can be determined is the displacement in their positions caused by the motion of the observer alone. It is calculated on the basis of the actual instantaneous motion of the Earth round the barycentre of the solar system.

Earlier, the practice was to resolve the stellar aberration into two components; one contributed by the circular motion of the Earth moving with a constant mean velocity round the Sun, and the other, a nearly constant displacement perpendicular to the major axis of the orbit arising due to ellipticity of the orbit of the Earth. The latter, known as the E-terms of aberration was included in the mean position of the stars as given in star catalogues and was omitted in the computation of day numbers. As a result, the mean places of stars differed from the catalogue mean places. This procedure was adopted to minimise the computation work for the user of star catalogues. However, this practice has caused much confusion lately because the accurate total velocity of the Earth referred to the barycentre of the solar system could not be used in computing stellar aberration. In accordance with a decision of the IAU in 1976, this occasion has been used to simplify this procedure by removing the E terms of aberration from the mean places and to include them in the reduction from mean to apparent place so that the apparent places remain unchanged. Thus, the mean places of FK5 are free from E terms. In other words, they will be the positions of the stars at epoch J 2000.0 as viewed from the barycentre of the solar system, in the co-ordinate system defined by the Earth's mean equator and equinox of J 2000.0.

The conversion of 1950.0 star catalogue positions ($\alpha,\delta$) to actual mean places ($\alpha+\Delta\alpha$, $\delta+\Delta\delta$) can be accomplished by :

$$\Delta\alpha = 0^{s}.0227 \sin(\alpha + 11^{h}.25) \sec\delta$$
$$\Delta\delta = 0''.341 \cos(\alpha + 11^{h}.25) \sin\delta + 0''.029 \cos\delta$$

For solar system objects, the displacement of the light source during the time ($\Delta t$) taken by light to travel from it to the Earth combined with the effect of relative motion of the Earth and the light is known as planetary aberration. Its computation requires a knowledge of the distance and motion of the light source and can be accomplished as follows. First, the barycentric position of the body at time $t-\Delta t$ is combined with the barycentric position of the Earth at time $t$ and then the correction for annual aberration is applied. Planetary aberration may also be

computed by interpolating the geometric (geocentric) ephemeris of the body to the time $t - \Delta t$. The light time $\Delta t$ is given by:

$$\Delta t \text{ (in days)} = 0.005\,7755 \text{ x distance in a.u.}$$

**Annual aberration** for reduction from a geometric place ($\alpha_0$, $\delta_o$) to an apparent geocentric place ($\alpha$, $\delta$) is given by :

$$\alpha = \alpha_0 + (-\dot{X} \sin \alpha_0 + \dot{Y} \cos \alpha_0) / (c \cos \delta_0)$$

$\delta = \delta_0 + (-\dot{X} \cos \alpha_0 \sin \delta_0 - \dot{Y} \sin \alpha_0 \sin \delta_0 + \dot{Z} \cos \delta_0) / c$, where c = 173.14 a.u./day and $\dot{X}, \dot{Y}, \dot{Z}$ are the velocity components of the Earth (pages 256 to 270 ).

The reduction of observations of the radial velocity to a common origin at the barycentre is given by adding the component of the Earth's velocity in the direction ($\alpha_0$, $\delta_0$) of the object :

$$\dot{X} \cos \alpha_0 \cos \delta_0 + \dot{Y} \sin \alpha_0 \cos \delta_0 + \dot{Z} \sin \delta_0$$

Differential annual aberration corrections to be added to the observed differences of right ascension and declination (in the sense moving object minus star) to give true differences are:

(R.A.) $a\ \Delta\alpha + b\ \Delta\delta$ (in units of $0^s.001$) ; (declination) $c\ \Delta\alpha + d\ \Delta\delta$ (in units of $0''.01$)

Here $\Delta\alpha$ is to be taken in units of $1^m$ and $\Delta\delta$ in units of 1'. The coefficients a, b, c and d are defined by:

$a = -5.701 \cos (H+\alpha) \sec \delta$
$b = -0.380 \sin (H+\alpha) \sec \delta \tan \delta$
$c = +8.552 \sin (H+\alpha) \sin \delta$
$d = -0.570 \cos (H+\alpha) \cos \delta$
$H^h = 23.4 - (\text{day of year}/15.2)$

(The day of year is tabulated on pages 4 to 12 )

**Annual parallax** correction can be calculated approximately for reduction from the catalogue place ($\alpha_0$,$\delta_0$) to the geocentric place ($\alpha$,$\delta$) using the following formulae;

$$\alpha = \alpha_0 + (\pi / 15 \cos \delta_0)(X \sin \alpha_0 - Y \cos \alpha_0) \text{ and } \delta = \delta_0 + \pi(X \cos \alpha_0 \sin \delta_0 + Y \sin \alpha_0 \sin \delta_0 - Z \cos \delta_0)$$

where $\pi$ is the annual parallax and X, Y, Z, are the coordinates of the Earth as given on pages 256 to 270.

**Deflection of light** in the gravitational field of the Sun may significantly affect the apparent direction of a star or of a body in the solar system. The elongation (E) from the centre of the Sun is increased by an amount that, for a star, depends on the elongation in the following manner:

$$\Delta E = 0''.004\,07 / \tan (E/2)$$

| E | 0°.25 | 0°.5 | 1° | 2° | 5° | 10° | 20° | 50° | 90° |
|---|---|---|---|---|---|---|---|---|---|
| ΔE | 1".866 | 0".933 | 0".466 | 0".233 | 0".093 | 0".047 | 0".023 | 0".009 | 0".004 |

The body disappears behind the Sun when E is less than the limmiting grazing value of about 8°.25. The effects in right ascension and declination may be calculated approximately from;

$$\cos E = \sin \delta \sin \delta_0 + \cos \delta \cos \delta_0 \cos (\alpha - \alpha_0)$$
$$\Delta\alpha = 0^s.000\,271 \cos\delta_0 \sin (\alpha - \alpha_0) / (1 - \cos E) \cos \delta$$
$$\Delta\delta = 0''.004\,07\,[(\sin \delta \cos \delta_0 \cos (\alpha - \alpha_0) - \cos \delta \sin \delta_0] / (1 - \cos E)$$

where $\alpha$, $\delta$ refer to the star, and $\alpha_0$, $\delta_0$ to the Sun.

# EXPLANATION

## TABULAR DATA

### PART-I -TIME SCALES AND EPHEMERIDES

Dates of year beginning in 2021 of various Indian and important foreign chronological eras are listed on page 3 followed by Gregorian calendar for the current year (pages 4 to 12 ). The calendar contains, besides the usual information, a count of Julian Day (JD) number for each date. The system of Julian day numbers maintains a continuous count of astronomical days, beginning with JD = 0 on 1 January 4713 B.C., Julian proleptic calendar. Julian Day numbers for other years can be found from the table on page 355. Various time scales used in this publication, their inter -relationships (as given on page 2 ) and the basis for computation of sidereal time as tabulated on pages 13 to 16; have been discussed above under the section on time scales. The concept of equation of time defined as the difference between local apparent solar time and local mean solar time (in the sense apparent minus mean ) is no longer used in astronomy and therefore, it is no more tabulated in this publication. It can, however, be obtained to a precision of about 1 second using the following relation :

Equation of time at $12^h$ U.T. = $12^h -$ tabulated value of TT of Sunôs ephemeris transit (pages 19 to 33 ).

In this publication, the ephemeridies of the Sun and planets were reported earlier based on computation jointly made by USNO and JPL by simultaneous numerical integration designated as DE 200/ LE 200. A more recent JPL ephemeris, DE 405/ LE 405 has now come into widespread use, provide barycentric equatorial rectangular coordinates for the period 1600 to 2201. The reference frame for basic ephemerides is the ICRF; the alignment onto this frame has an estimated accuracy of 1 - 2 arcseconds. The JPL DE 405/ LE 405 ephemerides have been developed in a barycentric reference system using a barycentric coordinate time scale $T_{eph.}$. The present edition use the DE 405/ LE 405 ephemeridies data on the positions of the Sun, Moon and planets. The value of some astronomical constants based on previously used DE200/ LE200 ephemeridies and currently used DE 405/ LE 405 ephemerides are given below.

| Constant | DE 405 Value | DE 200/ LE 200 Value |
|---|---|---|
| Light-time for unit distance, $\tau_A$ | 499.004 783 84 s | 499.004 7837é é é ..s |
| Geocentric gravitational constant, GE | $3.986\,004\,418 \times 10^{14} m^3 s^{-2}$ | $3.986\,004\,48$é é $\times 10^{14} m^3 s^{-2}$ |
| Heliocentric gravitational constant, GS | $1.327\,124\,42\,099 \times 10^{20} m^3 s^{-2}$ | $1.327\,124\,40$é é $\times 10^{20} m^3 s^{-2}$ |
| Ratio of mass of Sun to that of Earth, (GS)/ (GE) | 332 946.0 487 | 332 946.038é é é . |
| Ratio of mass of Moon to that of Earth, $\mu$ | 0.012 300 0371 | 0.012 300 034 |
| Obliquity of the ecliptic at J2000.0, $\varepsilon$ | $23° 26' 21''.406$ | $23° 26' 21''.4119$é . |
| Unit distance, A | $1.495\,978\,707 \times 10^{11}$ m | $1.495\,978\,7066 \times 10^{11}$ m |
| Ratio of mass of Sun to that of Earth + Moon | 328 900.5596 | 328 900.55 |
| Ratio of mass of Sun to mass of each planet : | | |
| Jupiter | 1047.348 644 | 1047.350 |
| Saturn | 3497.9018 | 3498.0 |
| Uranus | 229 02.98 | 229 60 |
| Pluto | $1.365\,66 \times 10^8$ | $1.3 \times 10^8$ |
| Pallas | $9.709 \times 10^9$ | $9.247 \times 10^9$ |
| Vesta | $7.407 \times 10^9$ | $7.253 \times 10^9$ |

# EXPLANATION

## The Sun

Mean elements of the orbit of the Sun can be calculated with the help of the following expressions for use during 2021 only :

| | | | | |
|---|---|---|---|---|
| Geometric mean longitude | : | L | = | $279^\circ.888\,875 + 0.985\,647\,36\ d$ |
| Mean longitude of perigee | : | $\Gamma$ | = | $283^\circ.298\,412 + 0.000\,047\,08\ d$ |
| Mean anomaly | : | $g$ | = | $356^\circ.590\,463 + 0.985\,600\,28\ d$ |
| Eccentricity | : | $e$ | = | $0^\circ.016\,699\,80 - 0.\,000\,000\,0012\ d$ |
| Obliquity of the ecliptic w.r.t. mean equator of date | : | $\varepsilon$ | = | $23^\circ.436\,548 - 0.000\,000\,36\ d$ |

where $d$ is the interval in days from 2021 January 0 at $0^h$ TT and is given by

$d$ = JD – 245 7387.5 = day of the year ( pages 4 to 12) + fraction of day from $0^h$ TT.

The above angular elements are referred to the mean equinox and ecliptic of date. The position of ecliptic of date with respect to the ecliptic of the standard epoch J 2000.0 is given by the formulae given under *Precession.*

The length of the principal years at 2021.0 as derived from the Sun's mean motion are given on page 2.

Geometric longitude of the Sun with respect to the mean equinox of date is tabulated on even numbered pages 18 to 32. Apparent longitude and latitude are with respect to the true equinox and ecliptic of date respectively. The two longitudes are related as follows :

Apparent longitude = Geometric longitude + nutation in longitude – 20".4955/ R.

Aberration has been computed by dividing 20".4955 by the true distance to the Sun. Precession in longitude is the total precessional displacement of a point along the ecliptic since the epoch J 2021.5. Revised value of the annual general precession p = $0^\circ.\,013\,971\,04$ (for J 2021.5) has been used to compute this quantity. Components of nutation are the results of summation of the revised series of nutation. The sum of the terms with period shorter than 35 days is separately tabulated under Besselian Day numbers (pages 244 to 251 ).

Apparent Right Ascension and true distance (radius vector), declination (tabulated on odd numbered pages 19 to 33) of the Sun have been computed from the original barycentric rectangular co-ordinates. Although the apparent right ascension and declination have been corrected for light time, the radius vector or the true geocentric distance in astronomical units is the geometric distance at the tabular time.

**The Semidiameter** is based on a value of $16'\,01''.18$ at unit distance being inclusive of an allowance for irradiation of $1''.55$. The tabular value is obtained by dividing $16'\,01''.18$ by the radius vector.

**Ephemeris Transit** is the TT of the transit of the Sun over the ephemeris meridian which according to its definition, is 1.002 7379 $\Delta$T east of the Greenwich meridian. Here $\Delta$T is the difference TT – UT. This transit time. This transit time can be interpolated to other meridians with an interpolating factor *p,* as follows:

$$p = -\lambda/360 + 1.002\,7379 \times \Delta T/86400$$

where $\lambda$ is the longitude (east positive). The interpolated TT can be converted into UT by subtracting $\Delta$T from TT.

**Equatorial rectangular co-ordinates** (geocentric) of the Sun, referred to the ICRS axes, are given in a.u. on pages 34 to 41. The direction of these axes have been defined by the IAU and realized in practice by the coordinates of several hundred extra galactic radio sources.

## EXPLANATION

**Horizontal parallax** ( page 17 ) of the Sun is the angle subtended at the Sun by the equatorial radius of the Earth. The new value of the Solar parallax $\Pi_o$ = 8".794 148 has been used to compute the horizontal parallax.

**Mean longitude and mean anomaly** (page 17 ) of the Sun have been computed using revised expressions for the mean motion of the Earth around the Sun as given on page 439.

**Heliographic co-ordinates** given on pages 42 to 45 for $0^h$ UT include the position angle P of the northern extremity of the axis of rotation measured eastward from the north point of the disc and the heliographic latitude $B_o$ and longitude $L_o$ of the central point of the disc.

The observed angular distance $\rho_1$ from the centre of the disc of the Sun of a feature on the Sunôs surface, as seen from the Earth, can be converted into its heliocentric angular distance $\rho$ from the centreof the Sunôs disc as follows :

$$\sin ( \rho + \rho_1 ) = \rho_1 /S, \quad \text{where } S \text{ is the semi diameter of the Sun.}$$

The observed position ($\rho$, $\theta$) of a feature (Sunspot, etc.) with respect to the centre of Sunôs disc can be converted into heliographic co-ordinates (L, B) as follows :

$$\sin B = \sin B_o \cos \rho + \cos B_o \sin \rho \cos ( P - \theta )$$
$$\cos B \sin (L - L_o ) = \sin \rho \sin ( P - \theta )$$
$$\cos B \cos (L - L_o ) = \cos \rho \cos B_o ï \sin B_o \sin \rho \cos ( P - \theta )$$

**The physical ephemeris of the Sun** has been calculated from the elements determined by R. C. Carrington (observation of the spots on the Sun, 1863).

**The Synodic rotation numbers** are given below according to R. C. Carringtonôs Greenwich photoheliographic series which commenced on 9 November, 1853 with number 1. The standard solar meridian from which heliographic longitudes on the surface of the Sun are measured (positive towards the west) is that which passes through the ascending node of the solar equator on the ecliptic on 1854 January 1, Greenwich mean noon. The beginning of each synodic rotation is the instant at which the standard solar meridian passes through the central point of the apparent disc of the Sun, i.e., when the heliographic longitude $L_o$ of this central point is zero.

### SYNODIC ROTATION NUMBERS, 2021

| Number | | Date of Commencement | | Number | | Date of Commencement | | Number | | Date of Commencement | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2239 | 2020 | Dec. | 25.93 | 2244 | | May. | 11.47 | 2249 | | Sept. | 24.58 |
| 2240 | 2021 | Jan. | 22.27 | 2245 | | June. | 7.68 | 2250 | | Oct. | 21.87 |
| 2241 | | Feb. | 18.61 | 2246 | | July. | 4.88 | 2251 | | Nov. | 18.17 |
| 2242 | | Mar. | 17.94 | 2247 | 2021 | Aug. | 1.09 | 2252 | 2021 | Dec. | 15.49 |
| 2243 | | Apr. | 14.23 | 2248 | | Aug. | 28.32 | 2253 | 2022 | Jan. | 11.82 |
| | | | | | | | | 2254 | | Feb. | 8.16 |

At the date of commencement of each synodic rotation period, the value of $L_o$ is zero ; that is, the prime meridian passes through the central point of the disk.

The mean rotational elements of the Sun during 2021 are as follows :

Longitude of the ascending node of the solar equator on the ecliptic of date is 76°.05, and on the mean equator of date 16°.17. Inclination of the solar equator on the ecliptic of date is 7°.25, and on the mean equator of date 26°.10. The mean position of the pole on the solar equator is at right ascension 286°.17 and declination 63°.91. Sidereal period of rotation of the prime meridian is 14°.18 44 per day and its mean synodic period of rotation is 27.2753 days.

# EXPLANATION

## The Moon

The ephemerides of the Moon reported in this publication are based on the fundamental arguments developed by Simon et. al (1994). The angular elements are referred to the mean equinox and ecliptic of date. Mean elements of the mean equator and of the orbit of the Moon (page 47) can be computed during 2021 with the help of the following expressions :-

The inclination $i$ of the mean equator of the Moon to the true equator of the Earth is given by :

$$i = 23^\circ.187\,5 - 0.001\,427\,d + 0.000\,000\,197\,d^2$$

The arc of the mean equator of the Moon from its ascending node on the true equator of the Earth to its ascending node on the ecliptic of date :

$$\Delta = 262^\circ.444\,9 - 0.053\,376\,d - 0.000\,001\,539\,d^2$$

The arc of the true equator of the Earth from the true equinox of date to the ascending node of the mean equator of the Moon :

$$\Omega' = -3^\circ.847\,5 + 0.000\,480\,d + 0.000\,001\,670\,d^2$$

The inclination $(I)$ of the mean equator of the Moon to the ecliptic = $1^\circ\,32'\,33''.6$.

The ascending node of the mean lunar equator on the ecliptic is at the descending node of the mean lunar orbit on the ecliptic that is at longitude $\Omega + 180^\circ$.

The above expressions give the mean elements with respect to the true equator of the Earth to a precision of about $0^\circ.001$.

The following expressions for the mean elements of the orbit of the Moon $\Gamma'$, $\Omega$ mean longitude of the Moon $L'$ and elongation $D$ are referred to the mean equinox and ecliptic of date.

Mean longitude of the Moon, measured along the ecliptic to the mean ascending node and then along the mean orbit :

$$L' = 114^\circ.689\,335 + 13.176\,396\,46\,d$$

Mean longitude of the Moon's perigee measured in the same way as $L'$ :

$$\Gamma' = 217^\circ.762\,099 + 0.111\,403\,40\,d$$

Mean longitude of the mean ascending node of the lunar orbit on the ecliptic :

$$\Omega = 78^\circ.915\,747 - 0.052\,953\,74\,d$$

Mean elongation of the Moon from the Sun :

$$D = L' - L = 194^\circ.800\,459 + 12.190\,749\,10\,d$$

Mean inclination of the lunar orbit to the ecliptic $= 5^\circ.156\,689\,8$

The above expressions are valid for use in 2021 only.

In all the above expressions, the time argument $d$ is the interval in days since $0^h$ TT January 0, 2021 and is given by $d = \mathrm{JD} - 245\,8118.5$

The length of the principal mean months at 2021.0 as derived from the above mean orbital elements of the Moon are given on page 2.

The apparent geocentric longitude and latitude of the Moon (pages 48 to 63) are referred to the true equinox and ecliptic of date. The true distance between the centres of the Earth and the Moon is given in a.u. Semi-diameter is derived from the horizontal parallax by $S = \mathrm{Sin}^{-1}(k \sin\pi)$ where $k = 0.272\,5076$. The semi-diameter at mean distance is taken to be $15'\,32''.58$ without making any correction for irradiation.

# EXPLANATION

The right ascension and declination given on pages 64 to 79 for 0 hour & 12 hour of TT are referred to the true equator and equinox of date.

Horizontal parallax is tabulated at twelve hourly intervals on pages 64 to 79. It is derived from $\sin^{-1}(1/r)$ where $r$ is the true distance in units of the Earthĉs equatorial radius. The tabulated R.A. and declination have been corrected for light time while the horizontal parallax is the geometric value for the tabular time.

The times of New Moon, First Quarter, Full Moon and Last Quarter are the moments at which the excess of the Moonĉs apparent longitude over that of the Sun is $0°$, $90°$, $180°$ and $270°$ respectively. Moon at Apogee and Perigee are the times when the Moon is at the greatest and least distance from the Earth. The timings are given in U.T. The corresponding timings in U.T. of the phases of the Moon are also given in the calendar portion on pages 4 to 12. For more precise values of the moments of New Moon and Full Moon, a reference may be made to Part VI - Indian Calendar where the times are given in I.S.T.

Moonĉs Age, given for $0^h$ TT, is the number of days elapsed since the preceding New Moon (conjunction). The times of Moonĉs upper and lower transit are given in TT for the ephemeris meridian. Interpolation to any other meridian by means of differences given and with the help of the ephemeris longitude will yield the local mean time of transit. The apparent geocentric declination given for the time of ephemeris transit can also be similarly interpolated.

Physical ephemeris of the Moon (pages 88 to 95) has been computed using the formulae and constants of D. Eckhardt (*The Moon and the Planets, 25 3, 1981; High precision Earth Rotation and Earth-Moon Dynamics, ed. O. Calame, pages 193-198, 1982)* with inclination *I* as given above ( IAU value).

In case of the Moon, selenographic longitudes are measured for a point on the surface of the Moon from the lunar meridian that passes through the mean central point of the visible disc positive towards the west towards Mare Crisium. Selenographic latitudes are reckoned positive towards the north limb. The mean central point of the disc is defined as the point on the lunar surface intersected by the radius of the Moon directed towards the Earth, when the Moon is simultaneously at the ascending node and coincident with the mean longitude.

The Moon presents roughly the same hemisphere to the Earth. However, due to non uniformity of the revolution of the Moon around the Earth (optical libration) and an oscillation of the actual rotational motion of the Moon about its mean rotation (physical libration), about 59% of the Moonĉs surface can be seen from the Earth. The contribution to the Earthĉs selenographic longitude and latitude due to physical libration has been tabulated separately. These are geocentric values.

The tabular selenographic longitude and latitude of the Earth are the selenographic co-ordinates of the apparent central point of the Moon from which point the Earth is in selenographic zenith. These co-ordinates are the total librations (sums of optical and physical librations) in longitude and latitude respectively. When the libration in longitude, i.e. the selenographic longitude of the Earth, is positive, the mean central point of the disc is displaced eastward exposing to view a region on the west limb. When the libration in latitude, i.e. the selenographic latitude of the Earth, is positive, a region on the north limb is exposed to view.

The selenographic co-ordinates of the point on the lunar surface where the Sun is in the Zenith are the selenographic co-ordinates of the Sun. The selenographic co-longitude of the Sun tabulated in the ephemeris is obtained by subtracting the selenographic longitude of the Sun from $90°$ or $450°$ ; it is approximately $270°$, $0°$, $90°$ and $180°$ at new-moon, first quarter, full-moon and last quarter respectively.

The position angle of the axis is the angle that the lunar meridian through the apparent central point of the disc towards the north lunar pole forms with the declination circle through the central point, reckoned counter clockwise from the north point of the disc.

# EXPLANATION

The position angle of the bright limb is the position angle of the mid point of the illuminated limb, reckoned eastward from the north point of the disc. The position angle of the two cusps may be obtained by adding $\pm\ 90^\circ$ to that of the bright limb.

The expression for calculating the selenographic altitude (a) of the Sun (above the lunar horizon ) at a point at selenographic longitude $l$ and latitude $b$ is as follows :

$\sin a = \sin b_\circ \sin b + \cos b_\circ \cos b \sin (c_\circ + l)$, where $(c_\circ, b_\circ)$ are the Sunôs co-longitude and latitude at the time.

The following expressions can be used to compute the differential corrections to be applied to the tabular geocentric librations to form the topocentric librations :

$$\Delta l \ = \ \text{ï}\ \pi' \sin (Q\ \text{ï}\ C) \sec b$$
$$\Delta b \ = \ + \pi' \cos (Q\ \text{ï}\ C)$$
$\Delta C \ = \ + \sin (b + \Delta b)\, \Delta l\ \ \text{ï}\ \pi' \sin Q \tan \delta$, where Q is the geocentric parallactic angle of the Moon and $\pi'$ is the topocentric horizontal parallax. The latter is obtained from the geocentric horizontal parallax ($\pi$) (pages 64 to 79) by using :

$$\pi' = \pi\ (\sin z + 0.0084 \sin 2\, z)$$
where $z$ is the geocentric zenith distance of the Moon. The values of $z$ and $Q$ may be calculated from the geocentric R.A. ($\alpha$ ) and declination ($\delta$ ) of the Moon by using :

$$\sin z \ \sin Q \ = \ \cos \phi \ \sin h$$
$$\sin z \ \cos Q \ = \ \cos \delta \ \sin \phi - \sin \delta \ \cos \phi \ \cos h$$
$$\cos z \ = \ \sin \delta \ \sin \phi + \cos \delta \ \cos \phi \ \cos h$$
where $\phi$ is the geocentric latitude of the observer and $h$ is the local hour angle of the Moon given by :
$h =$ local apparent sidereal time $- \alpha$

Second differences in the tabular values of the geocentric librations must be taken into account in interpolation for the time of observation.

## Major Planets

The heliocentric and geocentric positions of the major planets given on pages 96 to 197 have been derived directly from the numerical integration mentioned on page 442.

**The heliocentric longitude and latitude** are referred to the mean equinox and ecliptic of date. The tabular argument of heliocentric ephemeris is barycentric dynamical time (TDB).

**The apparent geocentric longitude and latitude** are referred to the true equinox and ecliptic of date and are planetary aberration. The apparent right ascension and declination are also corrected for planetary aberration and referred to the true equinox and equator of date. The tabular argument for both the terrestrial dynamical time (TDT). The TDT of transit over the ephemeris meridian has been furnished, which may be interpolated to any other meridian to obtain the LMT of transit.

As regards Pluto, in addition to the usual data, figures have been furnished for reduction of the apparent right ascension and apparent declination to the corresponding astrometric places referred to the mean equinox and equator of J 2000.0. The astrometric ephemeris is obtained by first adding the usual planetary aberration to the

planetôs true geocentric places referred to the standard equinox J 2000.0 and then subtracting the stellar aberration pertinent to the position occupied by the planet. The astrometric place is thus affected by the amount of the terms in the aberration dependent on the longitude of the Earthôs perihelion as are the catalogue mean places of stars in the neighbourhood. The astrometric ephemeris is, therefore, rigorously comparable with photographic observations that are referred to catalogue mean places J 2000.0 of neighbouring stars, it being only necessary to correct the observations for geocentric parallax in case of the planets and proper motion in case of the stars.

The tabular true distance from the Earth is the actual geocentric distance at the tabulated time and not at the instant when the light left the planet.

The horizontal parallax of planets is 8".794 143 divided by the geocentric distance. As regards the semi-diameter, the tabulated value is the value at unit distance divided by the geocentric distance. The semi-diameters at unit distance are as follows : Mercury 3".36, Venus 8".34, Mars 4".68, Jupiter 98".57 (Equatorial) and 92".12 (Polar), Saturn 83".13 (Equatorial) and 74".96 (Polar), Uranus 35".24, Neptune 34".14 and Pluto 2".07.

The heliocentric osculating elements of the orbits of the major planets, including Pluto, are given at intervals of 40 days on pages 200 to 201. The osculating elements are the elements of the instantaneous ecliptic orbit of the planet around the Sun determined by its actual position and velocity components for the instant, and as such the elements are affected by the attractions of other planets. The true place of a planet deduced from these elements is thus inclusive of the planetary perturbations, which need not, therefore, be considered separately in such a deduction.

The osculating elements for the Earth refer to the Earth/Moon barycentre. The correction in ecliptic rectangular co-ordinates in conversion from the Earth/Moon barycentre to the Earthôs centre is given by :

$$\text{Earthôs Centre} = (\text{Earth / Moon barycentre}) - (0.000\,0312 \cos L,\ 0.000\,2865 \sin L,\ 0.0000124 \sin L,$$
$$-0.00000718 \sin L, 0.00000657 \cos L, 0.00000285 \cos L)$$

where $L = 218° + 481\,268°\ T$, with $T$ measured in Julian centuries from JD 245 1545.0 to 5 decimals; the co-ordinates are in a.u. with reference to mean equinox and ecliptic of date.

## PART II - STARS

The mean places of 482 stars, apparent places of 68 stars at 10-day intervals. daily apparent place of *Polaris* and tables for finding latitude of place from altitude of polaris and azimuth of polaris are given in this section. The ecliptic co-ordinates (mean longitude and latitude) of 451 stars have also been given. To facilitate reduction from mean to apparent place of a star, Besselian Day Numbers as well as the barycentric position and velocity components of the Earth alongwith rotation matrix elements for precession and nutation have been tabulated.

### **Mean Places of Stars** (pages 215 to 226)

Beginning with the issue for 1988, calculation of the mean and apparent places are based directly on the basic-FK5 compiled by the A.R.I., Heidelberg.

The table for mean places of stars includes all stars of magnitude upto 3.9 as well as the component stars of the different lunar asterisms of the Hindus, Chinese and Arabian even when those are fainter than magnitude 3.9.

In case double or multiple stars, *m* denotes the mean position of the centre of gravity (*c.g.*) of the system; *p* the preceding component having less right ascension, *f* the following component and *A* the brighter component of the system. The magnitude of the binary stars is the integrated value for the two components.

# EXPLANATION

The mean longitude and latitude of 451 important stars have been computed using the conversion from equatorial mean positions to ecliptic co-ordinates. Similarly, annual variations in longitude and latitude, etc., are the differentials of the conversion formulae. All quantities relate to the middle of the current Julian year.

## Apparent Places of Stars ( pages 227 to 243)

The apparent places of 68 selected stars are reported under this section. These positions are completely based on the FK5 beginning with the issue for 1988.

Smaller aberration has been computed from the total velocity of the Earth referred to the barycentre of the solar system. The E-terms of aberration are no longer included in the mean places in the FK5, but rather in the reduction from mean to apparent places.

Reductions to apparent places have been computed rigorously and directly without the intermediary of the mean place for the begining of the year. The rigorous computation also includes effects of relativistic light deflection. Because of this, the apparent places of a star when approaching very closely the Sun cannot be interpolated by the user, but these cases are of no practical interest in normal applications.

Apparent places of 68 bright stars with annual variation and annual proper motion at 10-day interval have been given on pages 227 to 243. The number, name, are taken generally from the FK5, magnitude and spectrum are taken from SIMBAD data base. Corrections for parallax have been applied where appreciable.

The right ascension and declination are referred to the true equator and equinox of date but with the omission of the short period terms of nutation. After interpolating the given apparent places to date and longitude of the station, the following corrections for the effect of short period terms of nutation are to be applied :

$$\Delta\alpha = a\,d\psi + b\,d\varepsilon \quad \text{seconds of time}$$
$$\Delta\delta = a'\,d\psi + b'\,d\varepsilon \quad \text{seconds of arc}$$

where $d\psi$ and $d\varepsilon$ are short period terms of nutation as tabulated on pages 244 to 251. The values of $a$, $b$, $a'$ and $b'$ are given for each star under the apparent place.

**The Apparent places of Polaris** for each day of the year ( pages 272 to 274 ) have been computed rigorously.

## Besselian Day Numbers (pages 244 to 251)

All stellar data tabulations are now for the standard epoch at the middle of the current Julian year rather than the beginning of the Besselian year and accordingly the Besselian Day Numbers and second order day numbers are referred to the mean equator and equinox of the epoch, J 2021.5. Although for full precision the reduction to the apparent place has to be computed rigorously as described below, Besselian Day Numbers can still be used for less precision.

In the tabulated data, $\tau$ is the fraction of the Julian year since the standard epoch J 2021.5 A, B and E are Besselian Day Numbers designed to incorporate corrections to the position of a star on account of precession and nutation. In this case, the correction due to precession is measured from the middle of the year, and this is secured by incorporating in A the value of the precision corresponding to $\tau$.The terms of short-period in nutation are included in A and B, which are also shown separately on pages 244 to 251.

The Besselian Day Numbers C and D, designed to include the effect of aberration, are now computed based on the total velocity of the Earth.

Second order day numbers, needed only for high declination stars for high accuracy, have been tabulated on pages 252 to 255.

# EXPLANATION

The barycentric position and velocity components of the Earth and rotation matrix elements for rigorous reduction of precesision and nutation have been tabulated on pages 256 to 270. Use of these data with examples is discussed below :-

## Apparent place reduction with full precision (rigorous method)

Conversion of the barycentric co-ordinates of a star for the standard equinox and equator of J 2000.0 (TDB) to its apparent geocentric co-ordinates referred to the true equinox and equator of date ( TT ) can be done rigorously as follows:

The geocentric vector **P** of the star at the required epoch (ignoring the distinction between TDB and TT for the stellar case) is given be by:

$$\mathbf{P} = \mathbf{q} + T\mathbf{m} - \pi\mathbf{E_B} \text{ é é é .(1)}$$

Here **q** is the barycentric direction of the star at epoch J 2000.0 referred to the standard equinox and equator of J2000.0 and is given by :-

$$\mathbf{q} = (\cos\alpha_0 \cos\delta_0 ,\ \sin\alpha_0 \cos\delta_0 ,\ \sin\delta_0)$$

where $\alpha_0$ and $\delta_0$ are the right ascension and declination for the equator, equinox and epoch of J 2000.0.

The space motion vector $\mathbf{m} = (m_x, m_y, m_z)$ of the star in equation (1), expressed in radians/century, is given by :

$$\begin{aligned} m_x &= -\mu_\alpha \cos\delta_0 \sin\alpha_0 - \mu_\delta \sin\delta_0 \cos\alpha_0 + \nu\pi \cos\delta_0 \cos\alpha_0 \\ m_y &= \mu_\alpha \cos\delta_0 \cos\alpha_0 - \mu_\delta \sin\delta_0 \sin\alpha_0 + \nu\pi \cos\delta_0 \sin\alpha_0 \\ m_z &= \mu_\delta \cos\delta_0 + \nu\pi \sin\delta_0 \end{aligned}$$

where these expressions take into account the radial velocity (v ) in au/century (1 km/s = 21.094 952 75 a.u./ century), measured positively away from the Earth as well as proper motion( $\mu_\alpha$, $\mu_\delta$ ) in right ascension and declination in radian/century and $\pi$ is the parallax in radians.

T is the interval in Julian centuries from J2000.0, given by T = ( JD – 245 1545.0 )/ 36525; $\mathbf{E}_B$ and $\dot{\mathbf{E}}_\mathbf{B}$ in a.u. per day are Earthôs barycentric position and velocity vectors at co-ordinate time t = TDB referred to the equator and equinox of J 2000.0 (pages 256 to 270).

The heliocentric position of the Earth **E** is given by

$$\mathbf{E} = \mathbf{E}_B - \mathbf{S}_B \quad \text{é é é é é é é (2)}$$

Where $\mathbf{S_B}$ is the barycentric position of the Sun at time t. This can be obtained from the heliocentric position of the barycentre tabulated on page 202 by reversing the sign of the respective x, y, and z.

The geocentric direction **p** of the star and the unit vector **e** can be computed from $\mathbf{p} = \mathbf{P}/|\mathbf{P}|$ and $\mathbf{e} = \mathbf{E}/|\mathbf{E}|$

The geocentric direction $\mathbf{p_1}$ of the star after applying the correction for light deflection in the natural frame is obtained as follows:

$$\mathbf{p_1} = \mathbf{p} + (2\ \mu/c^2 E)(\mathbf{e} - (\mathbf{p.\,e})\,\mathbf{p})/(1 + \mathbf{p.\,e}) \text{é é é é ..(3)}$$

# EXPLANATION

Where $\mu/c^2 = 9.87 \times 10^{-9}$ a.u and $E = |\mathbf{E}|$, the vector $\mathbf{p_1}$ is a unit vector to the order of $\mu/c^2$ and dot (.) indicates scalar product.

The proper direction $\mathbf{p_2}$ in the geocentric inertial frame, that is moving with the instantaneous velocity **V** of the Earth relative to the natural frame, is given by:

$$\mathbf{p_2} = (\beta^{-1}\mathbf{p_1} + (1 + \mathbf{p_1}.\mathbf{V})/(1+\beta^{-1}))\mathbf{V})/(1+\mathbf{p_1}.\mathbf{V}) \text{é é é é é} \quad (4)$$

Where $\mathbf{V} = \dot{\mathbf{E}}_\mathbf{B}/c = 0.0057755\, \dot{\mathbf{E}}_\mathbf{B}$ and $\beta = (1 - V^2)^{-1/2}$; the velocity **V** expressed in units of velocity of light and is equal to the Earthôs velocity in the barycentric frame to the order of $V^2$.

The apparent geocentric direction $\mathbf{p_3}$ is obtained by applying precession and nutation to the proper direction $\mathbf{p_2}$ by multiplying it row by column with the rotation matrix M=NPB ( given on pages 257 to 271 ) as follows:

$$\mathbf{p_3} = M\,\mathbf{p_2} \text{ é é é é é é é ..} \quad (5)$$

The above direction $\mathbf{p_3}$ is in rectangular co- ordinates $(\xi, \eta, \zeta)$. It can be converted into spherical co- ordinates $(\alpha, \delta)$ using :

$$\alpha = \tan^{-1}(\eta/\xi) \quad \text{and} \quad \delta = \tan^{-1}(\zeta/\beta) \text{ é é é é é é} \quad (6)$$

Where $\beta = (\xi^2 + \eta^2)^{1/2}$

where the quadrant of $\alpha$ can be determined by the signs of $\xi$ and $\eta$.

**Correction for polar motion :**

The apparent geocentric direction $\mathbf{p_3}$, given by equation (5) above, is for the true equator and equinox with the z axis pointing towards the celestial ephemeris pole. A further correction for polar motion may be applied to $\mathbf{p_3}$ to obtain $\mathbf{p_4}$ i.e. the direction relative to the conventional terrestrial reference system in which the z-axis is in the direction of the adopted mean position of the pole, as follows :

$$\mathbf{p_4} = \mathbf{R_2}(-x)\,\mathbf{R_1}(-y)\,\mathbf{R_3}(\text{GAST})\,\mathbf{p_3}$$

where GAST is the Greenwich apparent sidereal time at the corresponding instant of UT and

$$\mathbf{R_1}(\theta) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\theta & \sin\theta \\ 0 & -\sin\theta & \cos\theta \end{bmatrix} \qquad \mathbf{R_2}(\theta) = \begin{bmatrix} \cos\theta & 0 & -\sin\theta \\ 0 & 1 & 0 \\ \sin\theta & 0 & \cos\theta \end{bmatrix}$$

$$\mathbf{R_3}(\theta) = \begin{bmatrix} \cos\theta & \sin\theta & 0 \\ -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

are the standard matrices that produce rotations through an angle $\theta$ about the x, y and z - axes respectively.

Polar motion is described by x and y, the co- ordinates of the celestial ephemeris pole with respect to the adopted origin; x and y are measured in seconds of arc from the origin along the meridians at longitudes 0° and 270°. Current values for the reduction of observations are published by the International Polar Motion Service and the Bureau International de lôHeure.

**Example of stellar reduction :**

Calculation of apparent position of a fictitious star on 2021, January 1 at $0^h$ TT from the catalogue data, mean right ascension ($\alpha_0$), declination ($\delta_0$), centennial proper motion ($\mu_\alpha$, $\mu_\delta$) in right ascension and declination, parallax ($\pi$) and radial velocity ($\nu$) of a fictitious star for the standard equinox and equator of J 2000.0 (TDB) as given below:

$\alpha_0 = 14^h\ 39^m\ 36^s.087$

$\mu_\alpha = -49.486$ s/ century
$= -0.003\,598\,72$ rad/century

$\delta_0 = -60°\ 50'\ 07''.14$

$\mu_\delta = +69''.60$ s/ century
$= +0.000\,337\,43$ rad/ century

$\pi = 0''.752$
$= 3.646 \times 10^{-6}$ rad

$\nu = -22.2$ km/ s
$\nu\pi = -0.001\,707\,36$ rad/ century

The barycentric position vector of the Sun and the position and velocity vectors of the Earth referred to J2000.0 on 2021 January 1, $0^h$ TDB (pages 202, 256 to 270) are :

| Vector | Julian date | Barycentric Rectangular Components x | y | z |
|---|---|---|---|---|
| $\mathbf{E_B}$ | 245 9215.5 | −0.185 767 253 | + 0.892 518 586 | + 0.387 018 278 |
| $\dot{\mathbf{E}}_\mathbf{B}$ | 245 9215.5 | −0.017 197 901 | −0.002 936 627 | −0.001 273 237 |
| $\mathbf{S_B}$ | 245 9215.5 | - 0.006 651 228 | +0.005 466 429 | +0.002 485 173 |

In order to calculate the geocentric vector **P** of the star at J 2000.0, using equation (1), the vectors **q** and **m** may be computed using positional data of the star.

$\mathbf{q} = (-0.373\,854\,098,\quad -0.312\,594\,565,\quad -0.873\,222\,624)$
$\mathbf{m} = (-0.000\,712\,684,\quad +0.001\,690\,102,\quad +0.001\,655\,340)$
$\mathbf{T} = (245\,9215.5 - 245\,1545.0)/\,36525 = +0.210\,006\,845$

The geocentric vector **P** may be computed from equation (1) by substituting the vectors **q, m** and $\mathbf{E_B}$ and time **T**.

$\mathbf{P} = (-0.374\,003\,089,\quad -0.312\,239\,632,\quad -0.872\,874\,992)$ and $|\mathbf{P}| = 0.999\,641\,260$

The heliocentric position vector **E** of earth may be obtained using equation (2)

$\mathbf{E} = (-0.179\,116\,025,\quad +0.887\,052\,157,\quad +0.384\,533\,105)$ and $|\mathbf{E}| = 0.983\,264\,862$

The unit vectors **p** and **e** in the direction of **P** and **E** respectively are as follows :

$\mathbf{p} = (-0.374\,137\,307,\quad -0.312\,351\,685,\quad -0.873\,188\,239)$

$\mathbf{e} = (-0.182\,164\,574,\quad +0.902\,149\,758,\quad +0.391\,077\,847)$

The scalar product $\mathbf{p.\,e} = -0.555\,118\,010$ and $2\mu/c^2 = 1.974 \times 10^{-8}$ a. u. The second term in the equation (3) represents the correction for the light deflection in the natural frame, and is given by the following vector :

$(2\mu/c^2\,\mathbf{E})\,(\mathbf{e} - (\mathbf{p.\,e})\,\mathbf{p})/\,(1 + \mathbf{p.\,e}) = (-0.374\,218\,360,\quad \_0.312\,353\,344,\quad -0.873\,152\,912)$

Addition of the above correction to the unit vector **p** gives geocentric direction $\mathbf{p}_1$ of the star :

$\mathbf{p}_1$ = ( – 0.374 137 325, – 0.312 351 652, – 0.873 188 243)

The velocity vector $\mathbf{V} = 0.000\ 1010\ \dot{\mathbf{E}}_\mathbf{B}$ and $\beta^{-1} = (1 - V^2)^{1/2}$ are as follows:

**V** = ( – 0.000 099 327, – 0.000 016 961, – 0.000 007 354)

$\beta^{-1} = 0.999\ 999\ 995$

The scalar product $\mathbf{p}_1 . \mathbf{V} = +\ 0.000\ 048\ 880$

Now substituting quantities computed above in the equation (4), the proper direction is obtained as:

$\mathbf{p}_2$ = (– 0.374 218 360, – 0.312 353 344, – 0.873 152 912)

The precession and nutation matrix (**M**) from page 257 is as follows:

$$\mathbf{M} = \begin{bmatrix} +0.999\ 987\ 289 & -0.004\ 624\ 301 & -0.002\ 009\ 211 \\ +0.004\ 624\ 289 & +0.999\ 989\ 308 & -0.000\ 010\ 719 \\ +0.002\ 009\ 239 & +0.000\ 001\ 427 & +0.999\ 997\ 981 \end{bmatrix}$$

Finally the apparent geocentric direction $\mathbf{p}_3$ is obtained by multiplying the proper direction $\mathbf{p}_2$ to the precession and nutation matrix as given by the equation (5).

Thus $\mathbf{p}_3$ = (– 0.371 014 839, – 0.314 071 139, – 0.873 903 490 ) and the apparent right ascension and declination:

$\alpha = \tan^{-1}(\eta/\xi) = 14^h\ 40^m\ 59^s.652$ ; $\delta = \tan^{-1}(\zeta/\beta) = -60^\circ\ 54''\ 55'.686$

# EXPLANATION

## PART III - Tables of Sunrise, Sunset, Twilight and Moonrise, Moonset

The times of Sunrise, Sunset and Twilight, which can be obtained immediately from the given tables by simple interpolation for the desired latitude within the scope of the tables, are in local mean time of the place. Strictly speaking, the timings of these events are for places on the meridian of Greenwich. By simple interpolation for longitude, the correct time (L.M.T.) for the station can be obtained, which can thereafter be reduced to the zonal standard time by applying correction of time pertinent to the place.

At the given times of Sunrise and Sunset, the upper limb of the Sun is on the horizon; the true zenith distance of the Sun's center is then taken as 90° 50′, allowing 16′ for semi- diameter and 34′ for horizontal refraction.

The timings of the beginning of morning twilight and ending of evening twilight relate to the instants when the center of the Sun is 18° below the horizon. This is now known as astronomical twilight. The period of twilight has been divided into three parts – Civil when the Sun is 6° below the horizon, Nautical when 12° and Astronomical when 18° and their duration have been given.

The timings of rising and setting in U.T. of a body with right ascension $\alpha$, declination $\delta$ and zenith distance z at latitude $\phi$ and east longitude $\lambda$ may be computed from

$$UT = 0.99727\ [\alpha - \lambda\ \pm \cos^{-1}\ \{(\cos z - \sin\phi \sin\delta)/(\cos\phi\ \cos\delta)\} - \text{GAST at } 0^{h}\ \text{UT}],$$

where each term is expressed in time measure and GAST at $0^h$ UT as tabulated on page 13. The negative sign in the expression corresponds to rising and positive sign to setting. If the quantity $\{(\cos z - \sin\phi \sin\delta)/(\cos\phi \cos\delta)$ is numerically greater than one, there is no phenomenon. However, the tabulated timings of Moonrise and Moonset have been computed by inverse by interpolation for the zenith distance at z = 90° 34′.001- 0.72755 $\pi$, where $\pi$ is the horizontal parallax of the Moon at the time of phenomena. The above value includes semi-diameter and the effect of refraction.

The Sunrise and Sunset times for certain stations in India (Kolkata, Varanasi, Chennai, Delhi, Mumbai) have been separately computed and given in Indian Standard Time. In these calculations the amount of horizontal refraction has been taken as 31′, the value derived from consideration of the atmospheric conditions in India, and consequently the zenith distance of the Sun's center is 90° 47′ at the times given. In the section on Indian Calendar, the Sunrise and Sunset times which have been given for latitude 23° 11′ North and Central Meridian of India, also relates to the times when upper limb of the Sun is on the horizon as in the general tables.

The Moonrise and Moonset times given for certain latitudes relate to the local mean time calculated for the Central Meridian of India. By simple interpolation with the help of a table given on page 313, the local mean time for any other latitude can easily be obtained. At the time given, the Moon's upper limb is on the horizon and so the true geocentric zenith distance of the Moon's center is 90° 34′ *plus* semi- diameter of the Moon *minus* the horizontal parallax, where 34′ has been allowed for horizontal refraction. Taking the mean values of the semi-diameter and the parallax, the zenith distance of the Moon at the moment is about 89° 52′, which varies from 89° 55′ to 89° 49′ as the parallax increases from 53′.6 to 61′.9.

The times of Moonrise and Moonset for certain stations in India (Kolkata, Chennai, Delhi and Mumbai) are separately calculated and given in I.S.T.

The times of Sunrise, Sunset and Moonrise, Moonset given are for an observer on the surface of the Earth considered to be a flat surface around that point without any obstruction in the directions of rising or setting. For an observer stationed at some elevation above the surface, the rising will be further accelerated and the setting retarded according to the height of the observer. The additional arc of depression to be considered on this account is 2′.10$\sqrt{h}$ where h is the height of the observer in meters above the ground level. The dip of the sensible horizon is however 1′.77 $\sqrt{h}$. The effect of atmospheric refraction is included in the above results, without which both the terms would have got reduced to the same value of 1′.93 $\sqrt{h}$.

## EXPLANATION

The values of the arc of depression according to height of the observer are given below:

| Height | Depression | Height | Depression | Height | Depression | Height | Depression |
|---|---|---|---|---|---|---|---|
| Meters | ′ | Meters | ′ | Meters | ′ | Meters | ′ |
| 0 | 0.0 | 40 | 13.3 | 300 | 36 | 2000 | 94 |
| 2 | 3.0 | 50 | 14.8 | 400 | 42 | 3000 | 115 |
| 5 | 4.7 | 75 | 18.2 | 500 | 47 | 4000 | 133 |
| 10 | 6.6 | 100 | 21.0 | 750 | 58 | 5000 | 148 |
| 20 | 9.4 | 150 | 25.7 | 1000 | 66 | 6000 | 163 |
| 30 | 11.5 | 200 | 29.7 | 1500 | 81 | 7000 | 176 |
| 40 | 13.3 | 300 | 36.4 | 2000 | 94 | 8000 | 188 |

The correction to the rising and setting times due to the above height of the observer may be obtained by multiplying the arc of depression given in the table by the figures from the table below:

**Latitude of Station**

| Decli. of Sun | 0° | 10° | 20° | 30° | 35° | 40° | 45° | 50° | 52° | 54° | 56° | 58° | 60° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ° ′ | m | m | m | m | m | m | m | m | m | m | m | m | m |
| 0 | .067 | .068 | .071 | .077 | .082 | .087 | .094 | .104 | .108 | .113 | .119 | .126 | .133 |
| 5 | .067 | .068 | .071 | .077 | .082 | .088 | .095 | .105 | .109 | .115 | .121 | .127 | .135 |
| 10 | .068 | .069 | .072 | .079 | .083 | .089 | .097 | .108 | .113 | .119 | .126 | .133 | .142 |
| 15 | .069 | .070 | .074 | .081 | .086 | .093 | .101 | .113 | .119 | .127 | .134 | .144 | .156 |
| 20 | .071 | .072 | .076 | .084 | .090 | .097 | .108 | .123 | .130 | .139 | .151 | .165 | .183 |
| 23 27 | .073 | .074 | .078 | .087 | .093 | .102 | .114 | .132 | .142 | .155 | .171 | .192 | .223 |

The deviation of the rising or the setting point on the horizon (i.e., amplitude) on account of the above arc of depression h (obtained after adding to it the normal depression at rising or setting) may be found as h tan $\phi$ sec A, deviation being towards the north in the northern hemisphere and south in the southern hemisphere. Here A, the amplitude of the rising of setting point measured from the east or west point of the horizon, is obtained from sin A – sin$\delta$ sec$\phi$. The values of the amplitude for certain latitudes and declinations are given in a table on page 365.

## PART IV — ECLIPSES AND OCCULTATIONS

Eclipses and Occultations have been calculated on the basis of the tabulated positions of the Sun and the Moon. The semi-diameters of the Sun and the Moon used in these calculations exclude irradiation. The Sun's tabular semi-diameter which includes irradiation is diminished by 1."55 for this purpose.

The semi-diameter of the Moon given by $\sin s = k \sin \pi$, where $\pi$ is the Moon's horizontal parallax is based on the adopted constant $k = 0.272\,5076$ to account for the irregularities of the lunar limb. It corresponds to the mean radius of Watt's datum as determined by observations of occultations and to the adopted radius of the Earth, introduced in 1982 and is consistent with the IAU system of Astronomical constants (1976). It is used with effect from 1986 in this publication. Refraction is neglected in calculation of eclipses of both the Sun and the Moon.

# EXPLANATION

The circumstances of the phenomena are given provisionally in Universal Time, using $\Delta T$ (A) = + $71^{s}.0$ and the points on the Earth's surface are also expressed in terms of geographic longitude measured positively to the east.

## Lunar Eclipses

In the calculation of lunar eclipses, the semi-diameter of the shadow -cone has been increased by one-fiftieth to take account of the influence of the atmosphere in absorbing Sun's rays passing through it . In the calculation of rising and setting limits, the time when the centre of the Moon becomes visible on the horizon has been considered as rising or setting. Elsewhere in this book the upper limb visible on the horizon is taken as the criterion for rising or setting. The horizontal refraction used in these calculations of rising and setting is 31′.

The method of computation of a lunar eclipse is detailed below :

Let $\alpha$, $\delta$ be the right ascension and declination of the Moon at an instant $T_0$ at or very near to the moment of opposition, and let $\alpha'$, $\delta'$ be the corresponding co-ordinates of the centre of the Earth's shadow ( $\alpha'$= R. A. of Sun + $12^h$, $\delta'$ = Sun's declination ). Let $\pi$, $s$ be parallax and semi-diameter of the Moon and $\pi'$, $s'$ be parallax and semi-diameter of the Sun.

As the Earth is not a perfect sphere, its shadow will differ slightly from a cone. It would however, be sufficient for our purpose if we use a mean radius for the Earth, which is equivalent to submitting for $\pi$ a parallax $\pi_1$, reduced to latitude 45°, so that $\pi_1 = 0.9983\,33\,\pi$.

The radius of the shadow-cone at Moon's distance is $1.02\ (\pi_1 + \pi' - s')$ for umbra, and $1.02\ (\pi_1 + \pi' + s')$ for penumbra.

Let $L$ be the angle between the centre of the Moon and that of the shadow-cone at the desired circumstance of the eclipse, so that

$L_1 = 1.02\ (\pi_1 + \pi' - s') + s$ . . . . . . . for first and last contacts

$L_2 = 1.02\ (\pi_1 + \pi' - s') - s$ . . . . . . . for second and third contacts

For the penumbral eclipse,

$L' = 1.02\ (\pi_1 + \pi' + s') + s$ . . . . . . . for first and last contacts

The Besselian elements x, y may be computed with sufficient accuracy with the following :

$x = (\alpha - \alpha')\cos\delta$ $\qquad x'$ = hourly variation of $(\alpha - \alpha')\cos\delta$

$y = (\delta - \delta')$ $\qquad y'$ = hourly variation of $(\delta - \delta')$

Let $m \sin M = x$, and $m \cos M = y$, so that $\tan M = x/y$, and $m^2 = x^2 + y^2$. The quantity m, taken always positive at all times, represents the angular distance between the centre of the Moon and of the shadow cone. The angle $M$ may take any value from 0° to 360°.

Again, let $n \sin N = x'$, and $n \cos N = y'$, so that $n^2 = x'^2 + y'^2$, and $\tan N = x'/y'$. The angle $N$ lies in the first or the second quadrant according as $y'$ is positive or negative. The value of $n$ is positive.

The time of greatest obscuration or middle of the eclipse is given by

$$T_0 - 1/n\ \{ m \cos (M - N) \} \quad \text{or} \quad T_0 - (x x' + y y')/n^2 \quad (\text{hours})$$

## EXPLANATION

The auxiliary angle $\gamma$ is given by :

$\sin \gamma = \{ m \sin (M - N) \} / L = (x y' - y x') / nL$. The value of either $L_1$, $L_2$ or $L'$ should be used or $L$ according to the circumstances of the eclipse under consideration.

Then, time of the beginning or ending = time of middle + (1/n) ( $L \cos \gamma$ ).

The value of $\gamma$ should be so taken that $\cos \gamma$ may be negative for the beginning and positive for the ending of the phase. In other words, when $\sin \gamma$ is positive, i.e., when $(M - N)$ falls in the 1st or the 2nd quadrant, $\gamma$ would be in the second quadrant for the beginning and in the first quadrant for the ending; and when $\sin \gamma$ is negative, i.e., when $(M - N)$ is in the 3rd or the 4th quadrant, $\gamma$ would be in the third quadrant for the beginning and fourth quadrant for the ending.

If greater accuracy is desired, the computations may be repeated using the times obtained above as initial times.

The magnitude of the eclipse, the Moon's diameter being unity, is $(L_1 - \Delta) / 2s$,

where $\Delta = m \sin (M - N)$ is taken positive. When the computations are repeated for greater accuracy, the average values of $L_1$, $\Delta$ and $s$ for the first and last umbral contacts or those corresponding to the time of greatest obscurations should be used.

When $\Delta$ becomes less than $L_2$, the eclipse is a total one. The computations of the beginning and ending of the total phase may be done in the same way as above using the value of $L_2$.

The position angle of contact $P$ on the Moon's limb, measured from the north point in the direction N.E.S.W. is $180° + N + \gamma$ for the first and last contacts both with umbra and penumbra as the case may be, and is $N + \gamma$ for the second and third contacts in case of a total eclipse.

When M is calculated for the exact time of the phenomena, i.e., beginning or ending, then $P$ may be obtained by considering $N + \gamma = M$, i.e., $P = M + 180°$ or $P = M$ as the case may be.

## Solar Eclipses

Computation of the elements and circumstances of solar eclipses has been done following the method of Bessel. The geometric position of the shadow of the Moon relative to the Earth is described by the Besselian elements in a system of geocentric rectangular co-ordinates. In this system, the geocentric plane perpendicular to the axis of the shadow is taken as the $xy$ plane and called the fundamental plane. The $x$-axis is the intersection of the fundamental plane with the plane of equator and is positive towards east. The $y$-axis is positive towards the north. The $z$-axis is parallel to the axis of the shadow and is positive towards the Moon. The tabular values of x and y are the co-ordinates of the axis of the shadow on the fundamental plane in units of the Earth's equatorial radius. The quantities d and $\varepsilon$ specify the declination and hour angle of the point on the celestial sphere towards which the axis of the shadow is directed.

The elements $l_1$ and $l_2$ are the radii of the penumbral and umbral cones on the fundamental plane. The elements $l_2$ is regarded as positive for an annular eclipse and negative for a total eclipse. The elements $f_1$ and $f_2$ are the angles between the axis of the shadow and the generators of the penumbral and umbral cones respectively.

The Besselian elements x, y, sin d, cos d, $\varepsilon$, $l_1$ and $l_2$ are computed and tabulated at an interval of 10 minutes to facilitate the accurate computation of the circumstances of the eclipse. The given eclipse maps show the path of the eclipse, beginning and ending times of the eclipse, the area of visibility and rising and setting limits of the eclipse.

## EXPLANATION

The method of computation of the local circumstances of the solar eclipse is given below :

The approximate time (U.T.) of the beginning and ending of a solar eclipse may be obtained from the corresponding eclipse map and used as estimated initial time. To obtain the geocentric rectangular co-ordinates, $\xi$,, $\eta$, $\zeta$ of the observer located on the surface of the Earth in geographic longitude $\lambda$ (measured east positive) and latitude $\phi$ in terms of the Besselian elements, we have;

$$\xi = \rho \cos \phi' \sin H$$

$$\eta = \rho \sin \phi' \cos d - \rho \cos \phi' \sin d \cos H$$

$$\zeta = \rho \sin \phi' \sin d + \rho \cos \phi' \cos d \cos H$$

and their variations per minute as :

$$\xi' = \varepsilon' \rho \cos \phi' \cos H$$

$$\eta' = \varepsilon' \xi \sin d - \zeta d'$$

where $H = \varepsilon + \lambda$ and $\varepsilon'$ is variation per minute in hour angle. In most of the cases, the variation $\zeta'$ is not needed and may be neglected. The values of $\rho \cos \phi'$ and $\rho \sin \phi'$ used above may be found for the observerôs latitude $\phi$ using Table ï XI.

The eclipse begins or ends at the station when $(x - \xi)^2 + (y - \eta)^2 = (l_1 - \zeta \tan f_1)^2$.

Now let $m \sin M = x - \xi$, $m \cos M = y - \eta$ so that $\tan M = (x - \xi)/(y - \eta)$ and $m^2 = (x - \xi)^2 + (y - \eta)^2$. The angle $M$ may have any value from 0° to 360° and $m$ is always positive.

Again let $n \sin N = x' - \xi'$, $n \cos N = y' - \eta'$ so that $\tan N = (x' - \xi')/(y' - \eta')$ and $n^2 = (x' - \xi')^2 + (y' - \eta')^2$. The angle $N$ is in the first two quadrants and $n$ is positive.

The radius of the shadow at a height $\zeta$ above the fundamental plane may be determined by $L_1 = l_1 - \zeta \tan f_1$ or $L_2 = l_2 - \zeta \tan f_2$ as the case may be.

Now the required time of the event will be obtained by applying a correction $\tau$ to the adopted initial time concerned, given by

$$\tau = -\{m \cos (M - N)\}/n + (L \cos \psi)/n \quad \text{(in minutes)}, \quad \text{where } \sin \psi = \{m \sin (M - N)\}/L$$

The value of $\psi$ for which $\cos \psi$ is negative should be taken for the beginning of the eclipse for the beginning of the annular phase or the end of the total phase, and the value of $\psi$ for which $\cos \psi$ is positive is to be taken for the end of the eclipse, for the end of the annular phase or the beginning of the total phase. When $M - N$ falls within 0º to 180º, $\psi$ is in the 2nd or the 1st quadrant according to the required phase of the eclipse, for the other half it is in the 3rd or the 4th quadrant according to the phase.

If the correction $\tau$ obtained above exceeds 3 or 4 minutes and greater accuracy is desired, the computation should be repeated using the new times now obtained as initial times.

For finding the time of greatest phase , the calculations should be started adopting a new assumed time midway between the beginning and ending times. The correction to this adopted time is given by:

$$\tau = -\{m \cos (M - N)\}/n \text{ (in minutes).}$$

## EXPLANATION

The magnitude of greatest partial eclipse is the fraction of the Sunôs diameter obscured by the Moon at the time of greatest phase, and is given by : $M_1 = (L_1 - \Delta) / (2 L_1 - 0.5459)$ where Δ, the minimum distance between the centres of the two bodies, is given by $m \sin(M - N)$ and is to be taken positive.

The magnitude of the central phase, in the same units, is $M_2 = (0.5459) / (2 L_1 - 0.5459)$.

The position angle of the point of contact measured from the north point of the Sun in the direction N. E. S. W. (i.e. clockwise direction) may be obtained from $P = N + \psi$ or if, measured from the vertex, from $V = P - C$ where C, the parallactic angle, is given by $\tan C = (\xi / \eta)$.

## Occultations

The occultations of visible planets and certain bright stars (*Aldebaran , Regulas, Spica and Antares)* by the Moon are given whenever they occur, together with the time, area of visibility and the Besselian elements. The area of visibility includes also the regions from which the occultations is visible even during day light hours. The two times given in the first table for the occultations are the times of first and last contact of the shadow cylinder with the Earth and as such the occultation may be expected to be visible only within the period between these times.

The elements are similar to those for solar eclipses and are given for $T_0$, the instant of conjunction in R.A. when x = 0. The common geocentric hour angle of the bodies, or more precisely of the line passing through the center of the Earth parallel to the line joining the center of the two bodies for the Greenwich meridians is $H_0$ and its hourly variation is about $60^m.16$ or $15^o.04$. $Y$ is the value of y for the instant of conjunction and x', y' are the hourly variations of x and y. For a place where an occultation is visible, the times of immersion and emersion can be computed with the help of these elements by a method similar to that used in computing the local circumstances of a solar eclipse as explained below:

Let φ and λ be respectively the latitude and longitude of the place. The longitude of place is to be taken in hours and minutes and as usual measured positively towards east of Greenwich.

For night visibility of an occultation, the necessary conditions are as follows:

(1) The Sun must not be much more than an hour above the horizon at the local mean time $T_0 + \lambda$ (and it must be below the horizon at time $T_0 + \lambda + t$).

(2) The Moon must be above the horizon by an appreciable amount, i.e., the quantity $H_0 + \lambda$, taken without regard to sign for this purpose, must be less than the semidiurnal are of the star of planet by at least one hour.

For prediction of an occultation, find the approximate time (U.T.) of local apparent connection by applying to the given $T_0$ a correction t (in hours) taken from the following table*:

$H_0 + \lambda$

| φ | h m<br>0-00<br>h | h m<br>0-30<br>h | h m<br>1-00<br>h | h m<br>1-30<br>h | h m<br>2-00<br>h | h m<br>2-30<br>h | h m<br>3-00<br>h | h m<br>3-30<br>h | h m<br>4-00<br>h | h m<br>4-30<br>h | h m<br>5-00<br>h | h m<br>5-30<br>h | h m<br>6-00<br>h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0° | 0.00 | 0.41 | 0.77 | 1.08 | 1.32 | 1.50 | 1.62 | 1.69 | 1.72 | 1.73 | 1.71 | 1.65 | 1.58 |
| 10° | 0.00 | 0.40 | 0.75 | 1.06 | 1.29 | 1.47 | 1.59 | 1.66 | 1.70 | 1.70 | 1.69 | 1.63 | 1.56 |
| 20° | 0.00 | 0.37 | 0.70 | 0.99 | 1.21 | 1.38 | 1.51 | 1.58 | 1.62 | 1.63 | 1.61 | 1.56 | 1.50 |
| 30° | 0.00 | 0.32 | 0.62 | 0.87 | 1.08 | 1.24 | 1.36 | 1.44 | 1.49 | 1.50 | 1.50 | 1.45 | 1.40 |
| 40° | 0.00 | 0.26 | 0.51 | 0.73 | 0.92 | 1.07 | 1.18 | 1.26 | 1.30 | 1.32 | 1.32 | 1.30 | 1.26 |
| 50° | 0.00 | 0.20 | 0.40 | 0.58 | 0.73 | 0.86 | 0.96 | 1.03 | 1.08 | 1.11 | 1.11 | 1.10 | 1.07 |
| 60° | 0.00 | 0.15 | 0.29 | 0.42 | 0.53 | 0.63 | 0.72 | 0.78 | 0.83 | 0.85 | 0.87 | 0.86 | 0.85 |

*The value of t has the same sign as that of $\sin(H_0 + \lambda)$.

The Besselian elements x and y at the time of local conjunctions $T_0 + t$ may be calculated as follows :

$x = x' t$, and $y = Y + y' t$.

## EXPLANATION

Occultations for which $y - \eta$ for the time local conjunction is not within ± 0.35 will not be visible at the place. In order to decide this, an estimated value of $\eta$ may be used as an approximation for which the following tables are given indicating the minimum and maximum values of $\eta$.

*Limiting value of* $\eta$ *(when on meridian i.e., when* $H_0 + \lambda = 0$ )

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $\varphi$ - d é é é | 0° | 10° | 20° | 30° | 40° | 50° | 60° |
| $\eta$ é é é | 0.00 | 0.17 | 0.34 | 0.50 | 0.64 | 0.76 | 0.86 |

The values of $\eta$ has the same sign as that of $\varphi$ - d.

(* The table has been constructed taking $x' = 0.5773$ ; for other values of $x'$ the figures will vary inversely. For this purpose the figures of the table may be multiplied by 1.15 for $x' = 0.50$, by 1.05 for $x' = 0.55$, by 0.95 or $x' = 0.60$ and by 0.89 for $x' = 0.65$)

*Limiting value of* $\eta$ *(when rising or setting i.e. when* $H_0 + \lambda + t$ *= S.D. arc)*

| | Latitude ( $\varphi$ ) | | | | | | |
|---|---|---|---|---|---|---|---|
| d | 0° | 10° | 20° | 30° | 40° | 50° | 60° |
| 0° | 0.00 | 0.17 | 0.34 | 0.50 | 0.64 | 0.76 | 0.86 |
| ± 9 | 0.00 | 0.17 | 0.34 | 0.50 | 0.65 | 0.77 | 0.87 |
| ± 18 | 0.00 | 0.18 | 0.36 | 0.52 | 0.67 | 0.80 | 0.91 |
| ± 27 | 0.00 | 0.19 | 0.38 | 0.56 | 0.72 | 0.86 | 0.97 |

The value of $\eta$ has the same sign that of $\varphi$

For the instant $T_0 + t$, compute the following quantities in addition to $x$ and $y$ :

Let H = ( H + $\lambda$ ) + $a\,t$ (converted into arc). The value of $a$ has been given for planets under elements; it is 1.027 for stars. The observerôs position on the fundamental plane is given by:

$$\xi = \rho \cos \varphi' \sin H \quad \text{and} \quad \eta = \rho \sin \varphi' \cos d - \rho \cos \varphi' \sin d \cos H$$

and the hourly variations ;

$$\xi' = 0.2618\, a\, \rho \cos \varphi' \cos H, \quad \eta' = 0.2618\, a\, \xi \sin d.$$

The value of the co-efficient 0.2618 a is 0.2625 for stars.

Let $u = x - \xi$, $v = y - \eta$, $u' = x' - \xi'$, $v' = y' - \eta'$ so that $n^2 = u'^2 + v'^2$.

Now $\sin \psi = (uv' - vu') / nl$, where l = 0.2725, for stars, and for planets, it will be found under elements.

The correction $\tau$ to the time of immersion and emersion is given by :

$$\tau = -\,(60/n^2)\,(uu' + vv') \mp (60\, l / n) \cos \psi$$

The negative sign in the second term is to be taken for immersion or the first contact and the positive sign for emersion or the last contact.

Instant of immersion or emersion = $T_0 + t + \tau$ .

If greater accuracy is desired, a second set of calculations may be done in the following way using the new times now obtained as initial times. For the revised time of immersion or emersion $T$, compute H = (H + $\lambda + at) + a\tau$, $x, y, \xi, \eta, \xi', \eta'$; $u, v, u', v'$ and D = $uu' + vv'$. The second correction t′ is given by : $t' = (30/D) \times [l^2 - (u^2 + v^2)]$ in mins. of time.

The final time of immersion or emersion = $T + t'$.

The angles of contact on the Moonôs limb:

## EXPLANATION

$P = M + 180°$, where $\tan M = (u + u't')/(v + v't')$,

$V = P - C$, where $\tan C = (\xi + \xi' t')/(\eta + \eta' t')$,

where t′ is to be taken in hours.

### PART V – Miscellaneous Tables

#### Phenomena

The stellar magnitudes of planets together with their elongations from the Sun have been given under "phenomena" at suitable intervals of days. The computation in the next portion of the phenomena has been based on longitude and that in the Astronomical Diary mainly on right ascension, with the exception that the conjunctions, squares and oppositions of planets with the Sun included in the latter have been calculated on the basis of longitudes. In the case of conjunctions in right ascension, the differences in declination between the planets or the Moon and the planet have also been given. The dates of heliacal visibility of planets ( Mercury to Saturn) have also been given and these are based on the method given on page 463.

#### Interpolation

*Interpolation Coefficients* have been given on pages 351 to 354 according to the formula of both Bessel and Everett, for each hundredth part of the time-interval.

Let the tabular value of a function given at equal intervals be represented by f and the first and second differences by Δ with relevant dashes and subscripts as shown below. It is required to determine the value of the function at some intermediate point.

| Function | First difference | Second difference |
|---|---|---|
| $f_{-1}$ | | |
| | $\Delta'_{-½}$ | |
| $f_0$ | | $\Delta''_0$ |
| | $\Delta'_{½}$ | |
| $f_1$ | | $\Delta''_1$ |
| | $\Delta'_{1½}$ | |
| $f_2$ | | |

The epochs for which the values of the function are to be taken should be so chosen that the time for which the value of the function is required may fall within the interval $f_0$ and $f_2$ and let n be the time interval from $f_0$ up to the moment for which the value of the function is required. It is expressed as a fraction of the interval at which the given values of the function are tabulated. Let $f_n$ be the value of the function for the desired time which is now required to be determined.

The two formulae for interpolation which are generally used for the purpose are as follows :

$$f_n = f_0 + n\,\Delta'_{½} + B''(\Delta''_0 + \Delta''_1) \ldots\ldots\ldots \quad \text{Bessel}$$
$$f_n = f_0 + n\,\Delta'_{½} + E_0''\Delta''_0 + E_1''\Delta''_1 \ldots\ldots\ldots \quad \text{Everett}$$

in which $f_0 + n\Delta'_{½}$ may be replaced by $(1-n)f_0 + nf_1$, if necessary, and where

$$B'' = n\,(n - 1)/\,4,\quad E_0'' = -\,n\,(n-1)\,(n-2)/\,6 \ \text{ and }\ E_1'' = n\,(n+1)\,(n-1)/\,6$$

It will be noted that in Bessel's formula the value of $\Delta''_0 + \Delta''_1$ is the same as $\Delta'_{1½} - \Delta'_{-½}$. The value of the coefficients $B''$, $E_0''$ and $E_1''$, all of which are negative within the range $f_0$ to $f_1$, will be obtained from the table on page 351 to 354 for the given value of $n$.

## EXPLANATION

Besselôs method of interpolation is more simple, but greater accuracy is yielded by Everettôs formula on account of the fact that it includes the effect of third differences also.

The more complete formula of Bessel is as follows :

$$f_n = f_0 + n\Delta'_{½} + \{n(n - 1)\,(\Delta''_0 + \Delta''_1)\}/4 + \{\,n(n-1)(n - ½\,)\,\Delta'''_{½}\,\}/6 + \cdots\cdots$$

The rate of variation of the function at a point, i.e., the instantaneous motion per unit of time interval may be obtained by the following formula :

Motion = $\Delta'_{½} + C\Delta_0'' + D\Delta_1''$, where $C = -(3n^2 - 6n + 2)/6$ and $D = (3n^2 - 1)/6$

When $n = 0$, the motion $f_0' = \{(\Delta'_{-½} + \Delta'_{½})/2\} - (\Delta_1'' - \Delta_0'')/6$,
when $n = ½$, $f'_{½} = \Delta'_{½} - \{(\Delta_1'' - \Delta_0'')/24\}$ and when $n = 1$, $f_1' = \{(\Delta'_{½} + \Delta'_{1½})/2\} - (\Delta_1'' - \Delta_0'')/6$

The stationary point (i.e., when $f' = 0$ ) occurs when $n = ½ - (\Delta'_{½}/\Delta''_1)$ or $½ - (\Delta'_{-½}/\Delta''_0)$.

### *Geocentric Co-ordinates and other Constants*

The tables given on pages 355 and 356 are for computing the geocentric co-ordinates of a place for which the geodetic, i.e., geographic or common latitude $\varphi$ is known. From the first table, the values of $\rho \sin \varphi'$ and $\rho \cos \varphi'$ can be directly obtained, while the second table gives the values of the geocentric latitude $\varphi'$ and the radius of the Earth $\rho$ separately

The constants used for these tables and the others given below are the 1976 I.A.U. System of astronomical constants introduced in this publication with effect from the 1985 issue.

Equatorial radius ($a$) = 637 8140 m = 3963.20 miles.
Polar radius ($b$) = 635 6755 m = 3949.91 miles.
Flattening of the Earth (f) = ($a$-$b$)/a = 1/298.257 = 0.003 353 64.
Ellipticity or eccentricity ($e$) = 0.081 8192, $e^2$ = 0.006 694 39.

The following expressions are obtained from the above values of flattening and radius of the Earth.

$S$ = 0.994 9743 − 0.001 6708 cos 2 $\varphi$ + 0.000 0021 cos 4 $\varphi$

$C$ = 1.001 6799 − 0.001 6820 cos 2 $\varphi$ + 0.000 0021 cos 4 $\varphi$

$\rho$ = 0.998 3271 + 0.001 6764 cos 2 $\varphi$ - 0.000 0035 cos 4 $\varphi$

$\varphi'$ = $\varphi$ - 11′ 32″.726 sin 2 $\varphi$ + 1″.163 sin 4 $\varphi$ - 0″.003 sin 6 $\varphi$

One degree of longitude (in km.) = 111.4133 cos $\varphi$ - 0.0935 cos 3 $\varphi$

One degree of latitude (in km.) = 111.1334 − 0.5598 cos 2 $\varphi$ + 0.0012 cos 4 $\varphi$

g (cm/sec²) = 978.031 + 5.1859 sin² $\varphi$ - 0.0057 sin² 2 $\varphi$ - 0.000 308$H$. where $H$ is the elevation in meters above sea level.

Period of Earth satellite of negligible mass = 84.489 09 $d^{3/2}$ mins., where $d$ is the mean distance of the satellite from the Earthôs center measured in units of 6378140 m (Earthôs equatorial radius).

Invariable plane of the solar system; $\Omega$ = 106°35′ 01″ + 3452″$T$, $I$ = 1° 34′ 59″ - 18″$T$

Pole of galactic plane (1950); $\alpha = 12^h\,49^m.0$, $\delta$ = +27° 24′

Solar apex (1950).. $\alpha = 18^h\,06^m$, $\delta$ = +30°

Solar motion = 20.0 km. or 12.4 miles per sec.

Speed of the Earth moving around the Sun = 29.79 km. or 18.51 miles per sec.

# EXPLANATION

## Heliacal Rising and Setting of Planets

The planets Mercury to Saturn (as well as the Moon) remain invisible to the naked eyes for some days at the time of conjunction with the Sun. This phenomenon of planet's invisibility due to its proximity to the Sun is known as combust or heliacal setting of the planets, and it plays an important part in Indian Calendar. The dates of heliacal setting and rising of the planets marking the period or invisibility have been calculated assuming that the phenomenon occurs when, at the given station, the Sun attains a Zenith distance of $90°+h$ at the time when the zenith distance of the planet is 90°. The values of h for different planets adopted for the purpose are as follows :

Mercury 10° (Direct) and 11° (Retrograde)
Venus 6°, Mars 14,° Jupiter 8°.5 , and Saturn 12°

The day of the first visibility of the lunar crescent after a new-moon day has also been determined in a somewhat similar way on the basis of the following values of the limiting altitude of the Moon above the horizon corresponding to its azimuth difference from the Sun, when the zenith distance of the Sun is 90°.

| | | | | | |
|---|---|---|---|---|---|
| Azimuth difference | 0° | 5° | 10° | 15° | 20° |
| Altitude | 10°.4 | 10°.0 | 9°.3 | 8°.0 | 6°.2 |

When the altitude of the Moon at sunset exceeds the above limit, the Moon is likely to be visible in that evening and when the excess is more than a degree, the Moon is sure to be visible. The beginning dates of the months of the Islamic Calendar have been determined on the basis of the above calculations and indicated on the date following that of the first visibility of the Moon.

In the above calculations, the atmospheric refraction and the horizontal parallax of the Moon are neglected.

The computations of heliacal rising and setting of planets and determination of the dates of first visibility of the Moon have been done for the central station of India.

## ASTRONOMICAL CONSTANTS*

Units : The units meter (m), kilogram (kg.) and second (s) are the units of length, mass and time in the International System of Unit (SI).

The astronomical unit of time is a time interval of one (*D*) of 86400 seconds. An interval of 36525 days is one Julian century.

The astronomical unit of mass is the mass of the Sun (*S*).

The astronomical unit of length is that length (*A*) for which the Gaussian gravitational constant (*k*) takes the value of 0.01720209895 when the units of measurement are the astronomical unit of length, mass and time. The dimensions of $k^2$ are those of the constant of gravitational (*G*), i.e. $L^3M^{-1}T^{-2}$. The term "unit distance" is also used for the length *A*.

**Defining Constants** :

1. Gaussian gravitational constant $k = 0.017\ 202\ 098\ 95$
2. Speed of light $c = 299\ 792\ 458\ ms^{-1}$

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**Primary Constants :**

| | | |
|---|---|---|
| 3. | Light-time for unit distance | $\tau_A$ = 499.004 78384 s |
| 4. | Equatorial radius for Earth | $a_e$ = 637 8136.6 m |
| | [IUGG value | $a_e$ = 637 8137 m] |
| 5. | Dynamical form-factor for Earth | $J_2$ = 0.001 082 6359 |
| 6. | Geocentric gravitational constant | $GE$ = 3.986 004 418 X $10^{14}$ $m^3$ $s^{-2}$ |
| 7. | Constant of Gravitation | $G$ = 6.674 28 X $10^{-11}$ $m^3$ $kg^{-1}$ $s^{-2}$ |
| 8. | Ratio of mass of Moon to that of Earth | $\mu$ = 0.012 300 0371 |
| 9. | General precession in longitude, per Julian century, at standard epoch J 2000.0 | $P$ = 5028".796195 |
| 10. | Obliquity of the ecliptic, at standard epoch J2000.0 | $\varepsilon$ = 23° 26' 21".406 |

**Derived Constants**

| | | |
|---|---|---|
| 11. | Constant of nutation at standard epoch J2000.0 | $N$ = 9".2052 331 |
| 12. | Unit distance | $c\tau_A = A$ =1.495 978 707 x $10^{11}$m |
| 13. | Solar parallax | arc sin ($a_e/A$) = $\pi\odot$ = 8".794143 |
| 14. | Constant of aberration for standard Epoch J2000.0 | $k$ = 20".49551 |
| 15. | Flattening factor for the Earth | $f$ = 0.003 352 82 = 1/298.25642 |
| 16. | Heliocentric gravitational constant | $A^3\,k^2/D^2 = GS$ = 1.327 124 42099 x $10^{20}$ $m^3$ $s^{-2}$ |
| 17. | Ratio of mass of Sun to that of the Earth | $(GS)/(GE) = S/E$ = 332 946.0487 |
| 18. | Ratio of mass of Sun to that of Earth + Moon | (S/E)/(1+$\mu$) = 328 900.5596 |
| 19. | Mass of the Sun | (GS)/G = S = 1.9884 x $10^{30}$ kg |

20. System of planetary masses :
(Ratios of mass of Sun to those of the planets etc.)

| | | | |
|---|---|---|---|
| Mercury | 6023600 | Jupiter | 1047.348644 |
| Venus | 408523.719 | Saturn | 3497.9018 |
| Earth + Moon | 328900.5596 | Uranus | 22902.98 |
| Mars | 3098703.59 | Neptune | 19412.26 |
| | | Pluto | 136566000 |

**Other quantities for use in the preparation of ephemerides :**

It is recommended that the values given in the following list should normally be used in the preparation of new ephemerides.

21. Masses of minor planets in unit of the solar mass :

| | |
|---|---|
| (1) Ceres | 4.72 x $10^{-10}$ |
| (2) Pallas | 1.03 x $10^{-10}$ |
| (3) Vesta | 1.35 x $10^{-10}$ |

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*See page 446 also for some of the constants actually used in preparation of the ephemerides reported in the publication.

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22. Masses of satellites in unit of the planet's mass :

| | | |
|---|---|---|
| Jupiter | Io | $4.704 \times 10^{-5}$ |
| | Europa | $2.528 \times 10^{-5}$ |
| | Ganymede | $7.805 \times 10^{-5}$ |
| | Callisto | $5.667 \times 10^{-5}$ |
| Saturn | Titan | $2.366 \times 10^{-4}$ |
| Neptune | Triton | $2.089 \times 10^{-4}$ |

23. Equatorial radii in km.

| | | | | | |
|---|---|---|---|---|---|
| Mercury | 2439.7 | Jupiter | 71492 | Pluto | 1195 |
| Venus | 6051.8 | Saturn | 60268 | | |
| Earth | 6378.1366 | Uranus | 25559 | Moon | 1737.4 |
| Mars | 3396.19 | Neptune | 24764 | Sun | 696000 |

24. Gravity fields of the planets.

| | $J_2$ | $J_3$ | $J_4$ |
|---|---|---|---|
| Earth | $+ 1.08263 \times 10^{-3}$ | $- 2.54 \times 10^{-6}$ | $- 1.61 \times 10^{-6}$ |
| Mars | $+ 1.964 \times 10^{-3}$ | $+ 36 \times 10^{-6}$ | |
| Jupiter | $+ 14.75 \times 10^{-3}$ | | $- 580 \times 10^{-6}$ |
| Saturn | $+ 16.45 \times 10^{-3}$ | | $- 1000 \times 10^{-6}$ |
| Uranus | $+ 12 \times 10^{-3}$ | | |
| Neptune | $+ 4 \times 10^{-3}$ | | |

25. Gravity field of the Moon.

$\gamma = (B-A)/C = 0.000\ 2278$

$\beta = (C-B)/B = 0.000\ 6313$

$C_{20} = - 0.000\ 2027$

$C_{22} = + 0.000\ 0223$

$C_{30} = - 0.000\ 006$

$C_{31} = + 0.000\ 029$

$S_{31} = + 0.000\ 004$

$C/MR^2 = 0''.392$

$I = 5552''.7 = 1^\circ\ 32'\ 32.7''$

$C_{32} = + 0.000\ 0048$

$S_{32} = + 0.000\ 0017$

$C_{33} = + 0.000\ 0018$

$S_{33} = - 0.000\ 001$

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